THE REFINER AND NATURAL GASOLINE MANUFACTURER

THE TECHNICAL LIBRARY OCT 1925

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Prevention of Evaporation in Gasoline Storage. By R. E. Wilson, H. V. Atwell, E. P. Brown and G. W. Chenicek.

Many Other Interesting Features.

Vol. 4 No. 10 OCTOBER, 1925 $1.00 Per Year

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"Towers and TAG" has now become an accepted slogan in the oil industry.

A little over a year ago, refinery men began to talk about the remarkable control of fractionation effected through the use of the TAG Peerless Automatic Controller. It was as if this automatic device had been designed especially for tower work—or as if the designers of towers had taken it for granted that TAG would produce The One Right controller.

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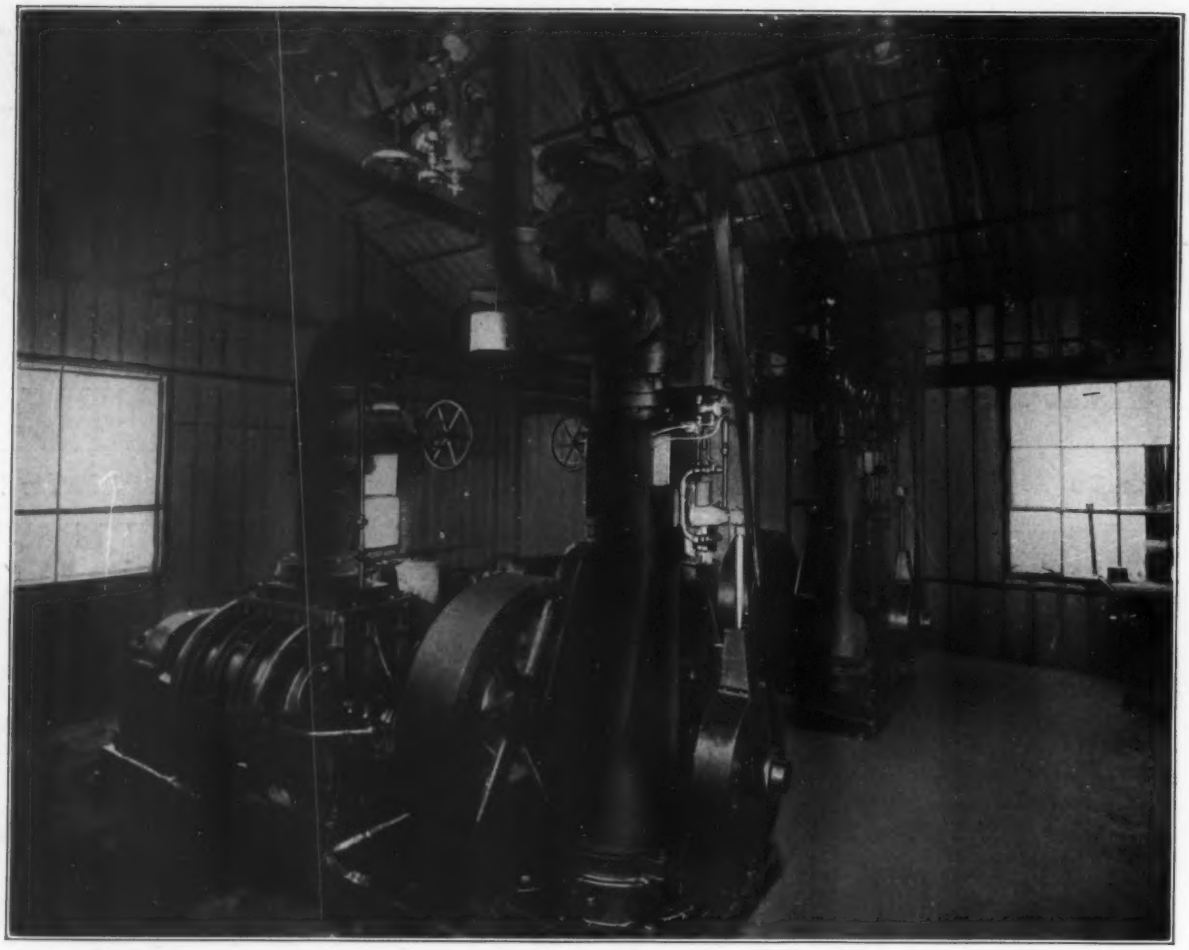

Roots Rotary Gas Pump, size 7, handling gas at the McMann Booster Station, Tonkawa, Okla.

Over 50% of Roots Orders Are Repeat Orders

Many oil companies who are using Roots equipment have sent in repeat orders for additional units. Comar, Barnsdall, McMann, Marland, Sinclair and Skelly are among those who appreciate the advantages of Roots Gas Pumps to the extent of purchasing more equipment.

We will gladly furnish you with sufficient test data to show you why Roots Gas Pumps are ideal for handling uncondensed still vapors and why Roots Rotary Pumps give the most satisfaction in handling anything from gasoline to tar.

Write for Bulletin 108.

ROOTS

You should have the following bulletins in your files:

113—Roots Rotary Pumps.

108—Roots Rotary Gas Pumps.

111—Roots Positive Displacement Gas Meters.

118—Engineering Tables.

Just ask the nearest office for them.

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MADE BY

Detroit Graphite Company

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GASOLINE made by our Process is clear and sparkling in visible pumps. It has a vastly superior odor to the acid treated product, which makes it more agreeable for the user. In addition our Process actually produces more gasoline and at a lower cost.

We are demonstrating the vapor phase method of refining cracked gasoline at the International Petroleum Exposition in Tulsa, October 1st-10th. Look for Booth 38—New York Building.

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NEWARK, NEW JERSEY

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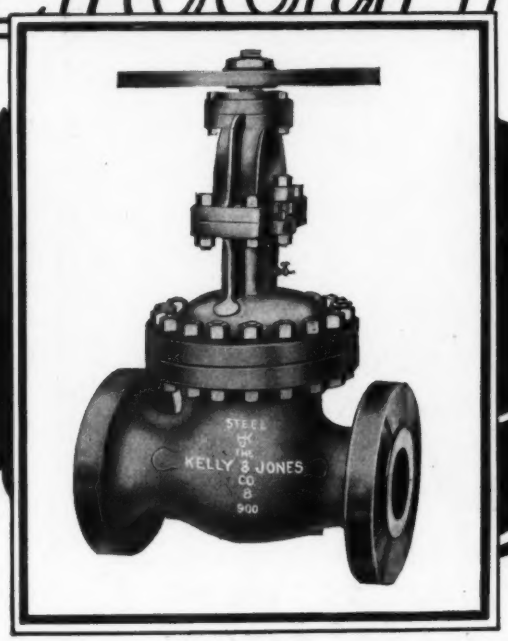
Electric Steel Valves



Valves of electric steel are available in sizes and styles to meet practically every requirement of oil and gas production and distribution and power plant service.

They are designed for steam or hot oil working pressures of 250, 400, 600 and 900 pounds, and for cold oil and gas working pressures up to 3000 pounds, conforming to the A. E. S. C. standards for these pressures. They are suitable for superheated steam temperatures of 500 to 750, and oil cracking temperatures of 800 to 900.

Tests of a number of consecutive heats of electric steel used in K. & J. valves have established its ability easily to meet the following specifications:

Tensile strength per sq. in.	65,000 to 85,000 lbs.
Elastic limit	35,000 to 45,000 lbs.
Elongation in 2-inch	22% to 35%
Reduction of area	30% to 40%
Cold bend over 1-inch radius	120 to 180
Sulphur	.025% to .045%
Phosphorous	.015% to .035%

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Power Plant Piping, Coils and Headers of all kinds made at our ETNA PLANT, Sharpsburg, Pa. Write for booklet.

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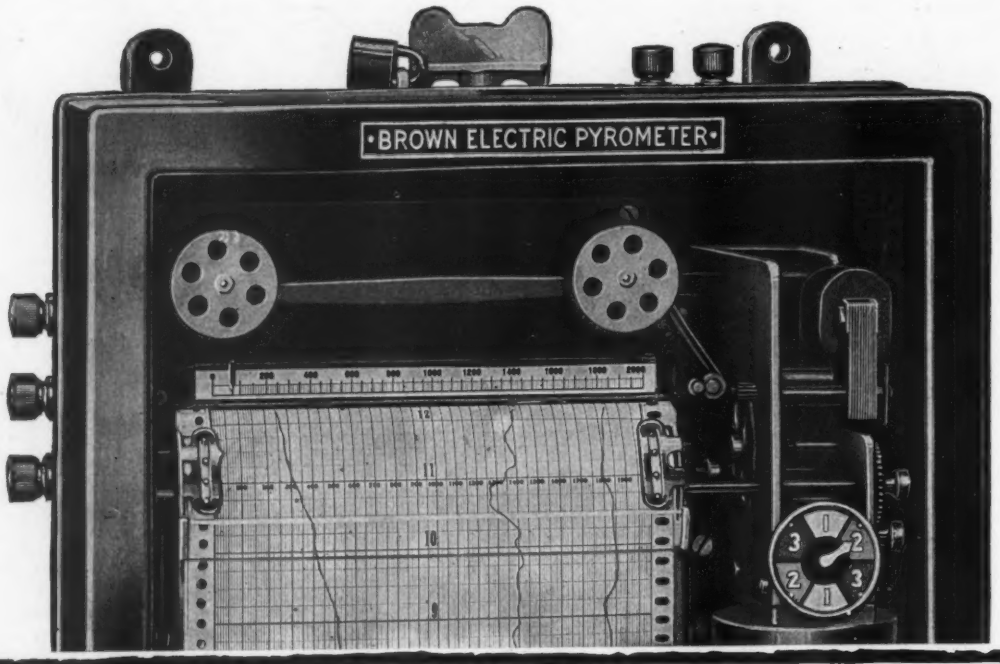


This is the **Brown** *New Design* **Recording Pyrometer**

Just a Few of Its Advantages

Charts 7 inches wide, with rectangular coordinates INDICATES as well as RECORDS.

Makes 1 to 12 records, in distinct colors.

Records visible as soon as made.

Rigid support permits easy writing on chart.

(Speed of chart travel changed by reversing two gears. Speeds from ¼ inch to 6 inches per hour can be supplied.)

Electric or hand-wound clocks, as desired.

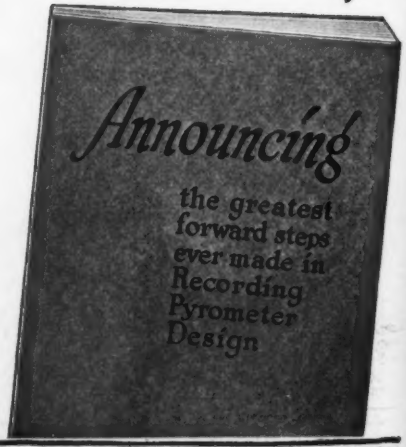
Convenient glass tear-off for chart.

Dial indicates thermocouple making records.

Switch alternately connecting thermocouple has gold contacts immersed in oil, preventing corrosion.

Every part absolutely accessible.

Complete automatic compensation for cold junction.. A patented Brown feature.



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ADDRESS—The Brown Instrument Company, 4537 Wayne Avenue, Philadelphia or one of our District Offices, at New York, Boston, Pittsburgh, Detroit, Chicago, Tulsa, Birmingham, Houston, San Francisco, Los Angeles, El Paso, Salt Lake City and Montreal.

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The growing favor being accorded the Jenkins Cracking Process is due to the fact that *on-the-ground* investigations substantiate the claims made for it.

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- *Tower Tanks*
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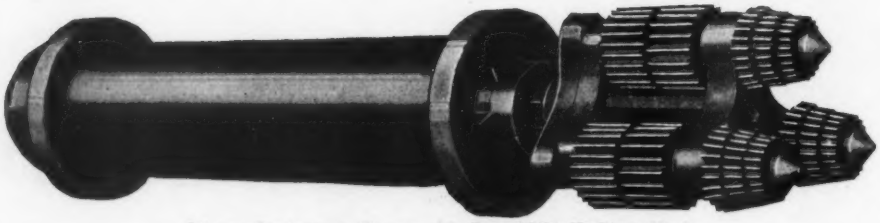
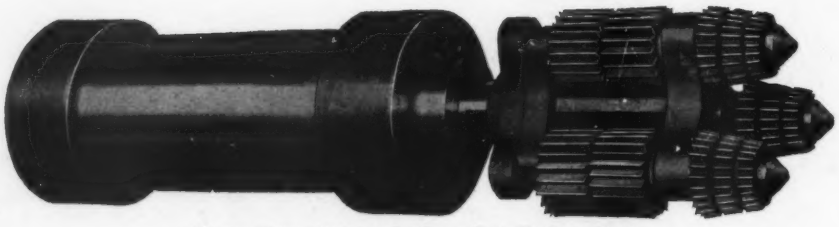


Liberty Tandemtype Cleaner with Type "SF" No-Rivet Head.



Liberty Victor Cleaner with Type "SF" No-Rivet Head.

These Cleaners Are Built for Oil Stills

It takes a rugged, sturdy tool to stand up under the hard service of cleaning coke deposits from pressure tube stills.

Liberty Cleaners combine the necessary power in the motor with supreme cutting ability in the cutter head. Both motor and head are ruggedly built to stand the test of hard usage. Worn cutters are readily replaced.

Take up with us your tube cleaner needs

Liberty Manufacturing Co.

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LIBERTY CLEANERS

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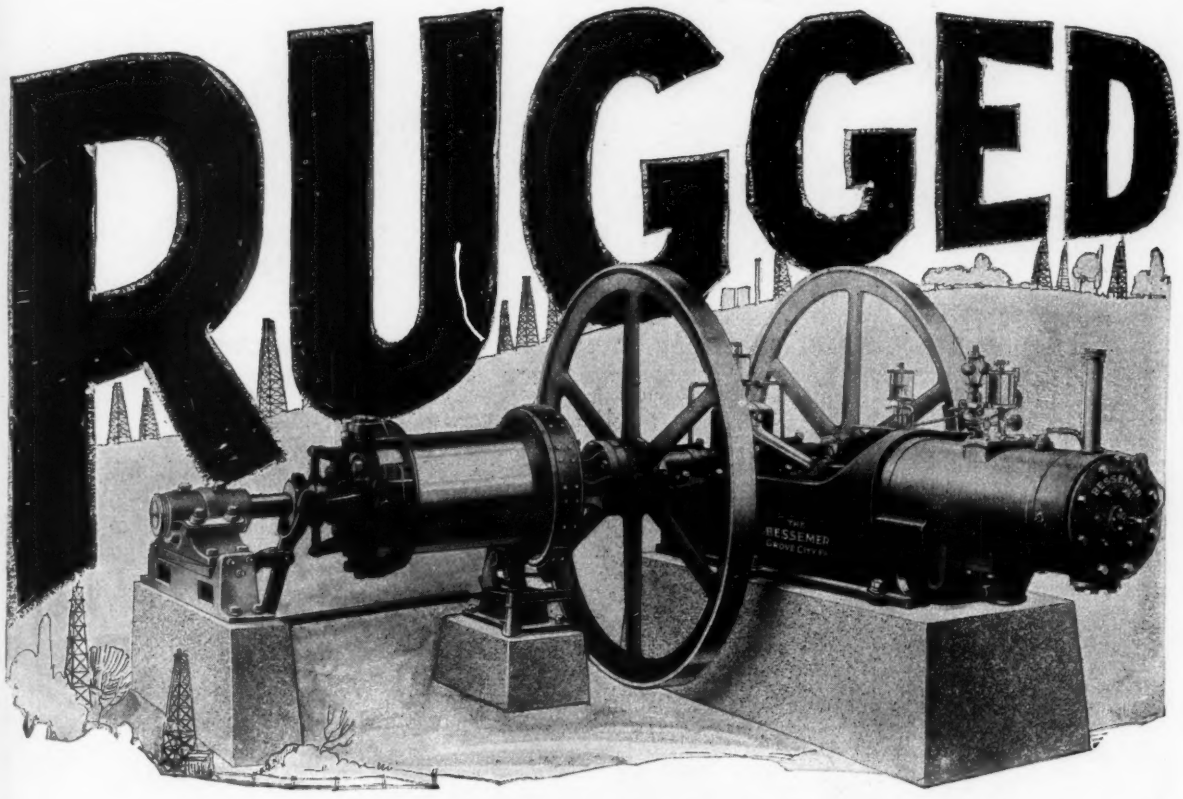

THESE husky Bessemer engines are rugged power plants that will outwork and outlast a couple of ordinary engines.

Every Bessemer part is built with a wide margin of extra strength—a feature of construction that makes life-long service positive. All bearings are oversize and easily adjusted; piston length exceeds the stroke to minimize wear; cross-head construction relieves top and bottom cylinder wear and STRENGTH is built into each part of every Bessemer.

Bessemers are rugged engines that cost less to operate and work longer.

they say—

"That Bessemer of ours is the runnin'est Engine I ever saw"

The most cordial invitation is extended the oil and gas fraternity to visit us, during the International Petroleum Congress Meeting in Tulsa, at our Tulsa office and warehouse, corner of First and Cincinnati Streets. Our latchstring will be out through the whole session.

THE BESSEMER GAS ENGINE COMPANY
18 York Street ∴ ∴ Grove City, Pa.

BESSEMER

BESSEMER OIL FIELD ENGINES – COMPRESSORS – VACUUM PUMPS – ROLLER PUMPING POWERS

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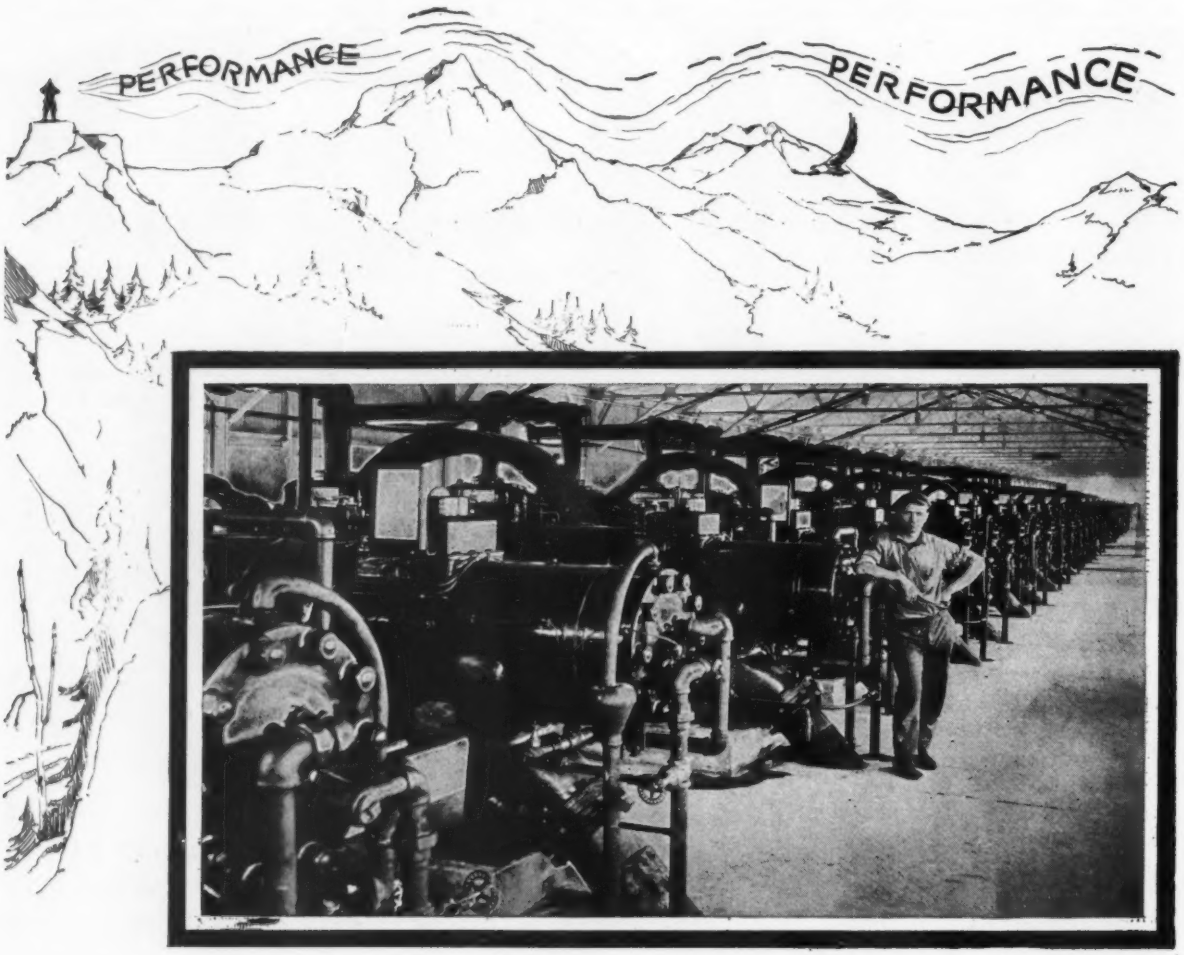

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The low, insistent drone of Clark Compressors is echoed and re-echoed throughout the length of the Oil Industry, in hundreds of installations that are proving conclusively that Clarks are the most compressor for the money.

In every plant in which they are installed the smooth flowing purr of Clark flywheels gives back the answer to continuous, trouble-free performance.

The above shows the Clark installation in the plant of one the largest operators in the Mid-Continent field.

Clark Bros. Co. Olean N.Y.

CLARK

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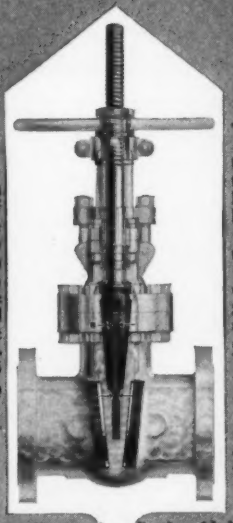
The Disc can't wobble—

IN THE NEW DESIGNS OF LUNKENHEIMER

IRON BODY GATE VALVES

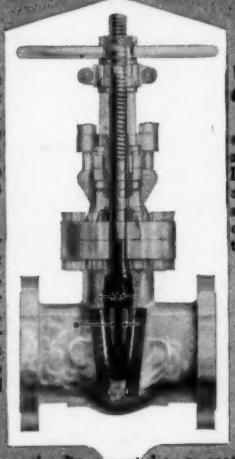
Valve Wide Open

Machined Guides are used in all sizes of Lunkenheimer Gate Valves, including the Standard as well as the Heavy and Extra Heavy Patterns. The ribs (A) in body and grooves (B) in disc are accurately machined, and are fully engaged even with valve wide open.



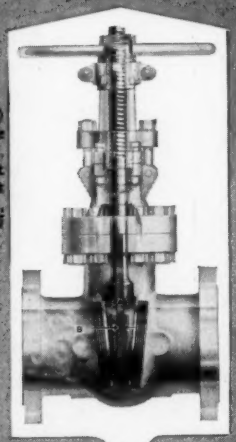
Valve Almost Closed

At this point the tendency for the disc to wobble increases. No wobbling in the Lunkenheimer design—clearance between ribs (A) and grooves (B) is so small and accurately gauged that pressure from either side cannot force disc against opposite seat. Thrust of disc is always against guides, and not against seating surfaces. Disc cannot drag on seats or touch them until valve is closed.



Valve Closes Tightly

And the ribs (A) and grooves (B) are still fully engaged. Disc rides straight and true to its seat and closes instantly, completely cutting off the flow.



Above views illustrate how disc is guided in its travel, and show why disc cannot drag on seats or touch them until valve is closed.

Other Outstanding Features

Face to Face Dimensions — Standard Trade Practice.

Heavy Bronze Seat Rings. Rings seat against solid walls of valve body—do not depend on a small flange to effect a joint with body.

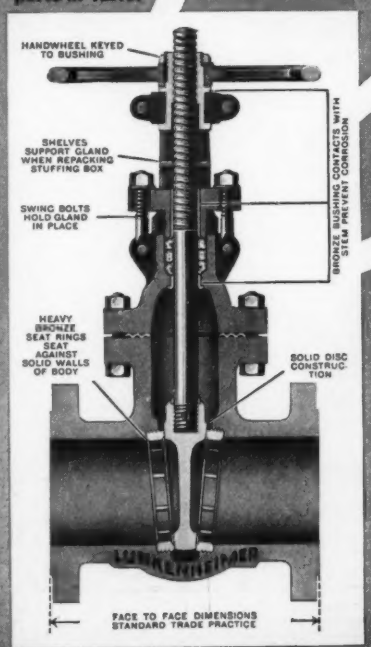
Solid Bronze Disc in sizes up to 6-inch; iron disc with bronze faces in 7-inch and larger sizes.

Bronze Bushing Contacts with Stem through yoke, gland and stuffing box prevent corrodible contact with iron parts of valve.

Swing Bolts hold gland in place; entire removal of nuts unnecessary to raise gland.

Two Shelves cast within yoke arms support gland when repacking stuffing box.

Interchangeability in the highest degree has been attained. All parts are renewable, including the seats and disc. Any replacement part will be exactly the same size as that which is to be renewed.


HANDWHEEL KEYED TO BUSHING
SHELVES SUPPORT GLAND WHEN REPACKING STUFFING BOX
SWING BOLTS HOLD GLAND IN PLACE
BRONZE BUSHING CONTACTS WITH STEM PREVENT CORROSION
HEAVY BRONZE SEAT RINGS SEAT AGAINST SOLID WALLS OF BODY
SOLID DISC CONSTRUCTION
LUNKENHEIMER
FACE TO FACE DIMENSIONS STANDARD TRADE PRACTICE

Lunkenheimer Iron Body Gate Valves are made in the Standard Pattern, 125 lb. W.S.P. 2 to 24 in.; Heavy, 175 lb. W.S.P. 2 to 16 in.; Extra Heavy, 250 lb. W.S.P. 1½ to 18 in.

Correct design, careful selection of materials and skilled workmanship combine to produce this, the highest development in gate valve construction.

Distributors in all commercial centers carry Lunkenheimer products in stock and render prompt service.

THE LUNKENHEIMER CO.

"QUALITY"

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Our extensive facilities for the production and transportation of Liquid Chlorine enable us to give the best of service to all refiners using our process. We also produce and market direct to the petroleum industry the following standard chemicals: Caustic Soda, in solid form and in tank cars of liquid solution of any desired strength up to 50% Sodium Hydroxide; Bicarbonate of Soda, for all foam type fire extinguishers; Bleaching Powder, sometimes used in making up hypochlorite solutions; Soda Ash, Anhydrous Ammonia and Aqua Ammonia. Quotations and shipping points gladly given on request.

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Caustic Soda ~ Liquid Chlorine
Bicarbonate of Soda
Anhydrous Ammonia

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Deal Direct with the Manufacturer

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Refineries

in Lands whose shores are washed by the waters of the Seven Seas

Use

A BRONZE WITH THE STRENGTH of STEEL
for STILL PLUGS
PYROMETER PROTECTION TUBES
VALVES and FITTINGS
CONDENSER BOX NIPPLES
BOLTS and NUTS or
for ANY PARTS WHERE
EXCESSIVE WEAR or CORROSION
IS A FACTOR

HILLS-McCANNA 45

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The Patent Situation
and
The Dubbs Cracking Process

It is a matter of pride with us that the general principles which constitute the Dubbs Cracking Process today, are the same as in the beginning of its career The elements are:

(*a*) A pipe still
(*b*) An enlarged expansion chamber
(*c*) A dephlegmator
(*d*) A condenser
(*e*) Operation under self-generated pressure, as defined in patent No. 1123502

Under later patents, we claim the exclusive rights for the Dubbs Process:

(1) The return of the reflux condensate to the system for further treatment, as defined in the claims of issued patent No. 1392629

(2) The return of the reflux condensate to the system for further treatment by forced (mechanical) means (pump), as defined in the claims of issued patent No. 1525281

(3) A controlled dephlegmation of the vapors, as defined in the claims of issued patent No. 1484445

(4) The "overhead feed" of the charging stock, as defined in the claims of issued patent No. 1488325

(5) Operation at differential pressures in the system, as defined in the claims of issued patent No. 1534927

(6) The passage of independently heated streams of charging oil and reflux condensate to a common vaporizing zone as defined in claims of issued patent No. 1537593

(7) The "split feed" of the charging stock, part overhead, part direct to the heating elements, as defined in the claims of issued patent No. 1522425

(8) The passing of the heated oil, through a series of heated vaporizing chambers, as defined in the claims of issued patent No. 1440772

(9) Passing the oil in a closed cycle through the heated element and expansion chamber with recracking of reflux condensate and withdrawal of heavy residuum, as defined in the claims of issued patents No. 1534927 and No. 1281884

(10) Bubbling the vapors through oil pools in the dephlegmator with heat interchange with the charging stock, as defined in claims of issued patents No. 1488325, No. 1525281 and No. 1546634

(11) A coke-like carbonaceous fuel produced by cracking, as defined in the claims of issued patent No. 1517830

There are numerous other patented features embodied in the Process and covering the apparatus We have more than 700 pending applications for patents

* * *

You never find an unsuccessful device or process infringed The greater its success, the greater the temptation

"Pirating is an old art—it started on the high seas
Infringement is its wicked partner and successor on land"

There are two types of infringers

(*a*) Those who claim they didn't know

(*b*) Those who do know, but deliberately appropriate the rights of others

By means of this announcement, we want to eliminate all those who belong to class "a"—Everyone shall know

We shall then by orderly legal proceedings endeavor to establish our rights and protect our licensees against infringement of our patents

Universal Oil Products Company
Owners of the Dubbs Process
310 South Michigan Ave
Chicago Illinois

The TERRY Tree
Has no Dead Branches
FOR HEATING BUILDINGS
DYEING AND BLEACHING
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DISTILLATION
FOR ALL KINDS OF PROCESS HEATING
FOR DRYING
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POWER FOR MISCELLANEOUS PURPOSES
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CLEAN PROCESS STEAM AT ANY PRESSURE UP TO 130#
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Use the exhaust steam from a Terry reducing turbine for your process heating. You will thereby obtain your electrical power for as low as .4 cents per K. W. hour.
May we send you an analysis of the power costs of an industrial plant employing the Terry process steam and power system?
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The REFINER
and NATURAL GASOLINE MANUFACTURER

EDITED MONTHLY AT TULSA, OKLAHOMA

GRADY TRIPLETT, *Editor*

Published by
GULF PUBLISHING COMPANY
HOUSTON, TEXAS

R. L. DUDLEY, *President* A. L. BURNS, *Gen'l Mgr.*

Volume 4 OCTOBER Number 10

For men engaged in the operating branch of the refining and natural gasoline business

Price.....$1 per year

Advertising rates upon application to nearest office

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Exposition Offers Enlightenment on Manufacturing

By Grady Triplett

Tulsa, Oklahoma.—For the third annual International Petroleum Exposition and Congress, October 1 to 10, the program of the congress has been segregated from the exposition proper. The exposition will continue through the 10 days, using its own grounds at Peoria, Madison and Archer Streets, while the congress will consist of morning sessions three days of the convention.

The International Petroleum Congress will bring up the serious phases of the petroleum industry. Its programs, October 5, 6 and 7, will be in the Crystal ball room of the Mayo hotel. From 10 until 12 o'clock each morning subjects bearing either directly or indirectly on the petroleum industry in all its phases will be discussed by men of eminent standing in both business and scientific fields.

The evening of October 5 will be the occasion of a formal reception at the Mayo hotel in honor of those coming to take part in the Congress programs.

Those on Program

W. G. Skelly, president of the International Petroleum Exposition and Congress, will open the congress and will introduce Hon. M. E. Trapp, Governor of Oklahoma. This will take place the morning of October 5.

Among the other speakers for the Congress will be: Henry J. Allen, editor of the Wichita Beacon and ex-Governor of Kansas.

J. Edgar Pew, president of the American Petroleum Institute.

Senor Sanches Latour, minister, and official representative from Guatemala.

W. G. SKELLY
President International Petroleum Exposition

The Congress program and speakers follow:

Monday, October 5

Honorable W. G. Skelly, President International Petroleum Exposition and Congress: Opening Address.

Honorable M. E. Trapp, Governor of Oklahoma: Address.

Mr. J. Edgar Pew, President American Petroleum Institute: "American Oil Resources — Demand and Supply."

Dr. Santiago F. Bedoya, Secretary of the Peruvian Embassy and Official Representative of Peru: Paper.

Mr. W. R. Guiberson, Official Representative of California Chamber of Mines and Oil: "Taxation of Oil Properties."

Dr. Lucio Baldo, Official Representative from Venezuela: "Producing, Marketing and Transporting Oil Problems in Venezula."

Mr. Chas N. Gould, Director Oklahoma Geological Survey: "The Mineral Resources of Oklahoma and Their Relation to the Petroleum Industry."

Tuesday, October 6

Mr. D. M. Strickland, Research Engineer American Rolling Mill Company: "The Economy of Pure Iron in the Oil Industry."

Mr. K. C. Heald, Chariman of the Committee on Studies in Petroleum Geology, National Research Council.

Official Representative from Mexico: Paper.

Hon. Henry J. Allen, ex-

GARLOCK

RIGHT!

CORNER OF METALLURGY LABORATORY

By RIGHT, we mean
Garlock Metal Packings
are MECHANICALLY RIGHT

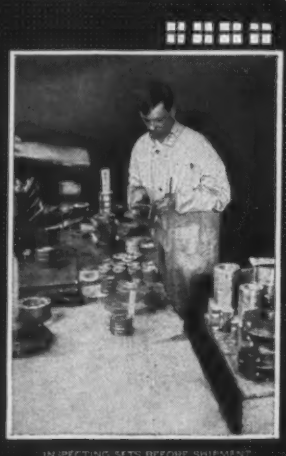
All metals used in the manufacture of Garlock Metal Packings are alloyed to our specification and have to stand rigid tests.

The Packing Rings are tested for specified hardness according to the service they have to render.

Every set of Packing shipped is inspected to determine if it is Mechanically Right as to fit, workmanship and micrometer measurements.

When Garlock Metal Packing Service is installed in your Plant you are receiving the last word in Metal Packing Craftmanship.

TESTING PACKING RINGS FOR HARDNESS



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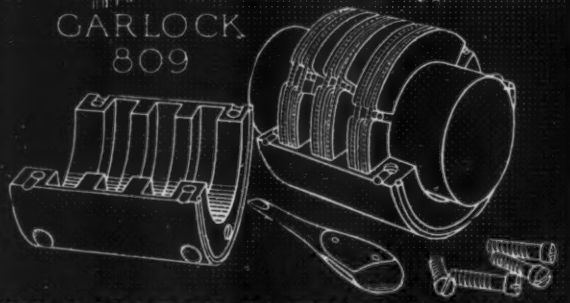

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ALF. G. HEGGEM
Second vice-president, International Petroleum Exposition

Governor of Kansas: "Oil's Contribution to the Prosperity of the West."

Mr. Edward P. Bailey, Past President and Official Representative of American Oil Burners Association: "Fuel Oil."

Dr. R. R. Mathews, Chairman Petroleum Division, American Chemical Society: "The Service of Chemistry in the Development of the Petroleum Industry."

Dr. Hellmuth Wolff, Halle University, Germany: "The Establishment of the Statistical Service for Petroleum."

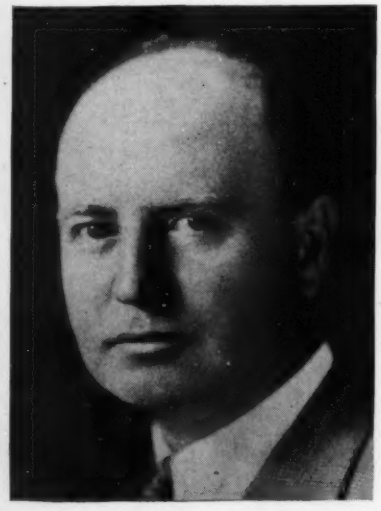
Wednesday, October 7

Dr. Walter Dill Scott, President Northwestern University, Chicago: "Contributions Which Have Been Made and Are Being Made by Universities Toward the Development and Progress of the Oil Industry."

Senor Francisco Sanches Latour, Minister from Guatemala and Official Representative of that Country.

Mr. C. F. Kettering, President General Motors Research Corporation.

Mr. Glenn Griswold, Editor Chicago Journal of Commerce.



WILLIAM HOLDEN
Secretary of the Exposition

Dr. Martin C. Gavin, Shale Technologist, U. S. Bureau of Mines: "Shale."

Chance to Learn

This program of three days will resolve itself in something of a symposium on petroleum. Through this those attending the event will have opportunity to listen to some of the leading men of American business and professional pursuits.

It is in the program of the Congress where those concerned with the manufacturing branch of the petroleum industry will find discussions of vital interest to their business. Strictly technical subjects are not likely to have consideration, but it is certain that economical questions which bear on the use of petroleum products will be discussed. Those who design motors will be heard and the work these men do has a direct bearing on gasoline consumption, as well as that of lubricating oil.

General economic conditions are known to have a bearing on gasoline consumption. Statistics show this. But refiners have been accused of giving general economic conditions no consideration when determining their output and operating conditions. In several of the speakers of the International Petroleum Congress, the refiner will have opportunity to learn of general economic conditions, under conditions, which may be made profitable in plant operation.

Exhibits Worth Study

While the International Petroleum Exposition is not primarily a place for gathering knowledge, it does offer an opportunity of that type. Its restriction is that it is limited to equipment, if that can be classed as a restriction.

The leading manufacturers of refinery and natural gasoline plant equipment will have exhibits of the latest and best in machinery for the extraction of gasoline from either crude oil or casinghead gas. No branch of the petroleum industry is changing more rapidly than that of manufacturing. And the change is due largely to advances in manufacture. So the man desiring to learn what is newest in the way of plant equipment can learn in the shortest time by visiting the exhibits of the International Petroleum Congress.

These exhibits offer the opportunity for learning of refinery progress and offer the further opportunity of making purchases of equipment at the time. For the Exposition is as much of a buying and selling opportunity as it is an exhibit for advertising and study.

All is not serious with the International Petroleum Exposition and Congress. It has its entertaining features and its fun side. The parade and pageant of the royalty of petroleum will be one of the outstanding features of the event. Fred E. Windsor of Warren, Penn., will reign over the land of petroleum during the 10 day period. Queen Petrolia will be present in the person of Miss Ramona Marcella Trees of Winfield, Kansas. She was selected at the close of the Exposition of 1924 from the princesses sent from the several states, which produce crude oil.

This method will be followed again,

FRANK J. HINDERLITER
First vice-president International Petroleum Exposition

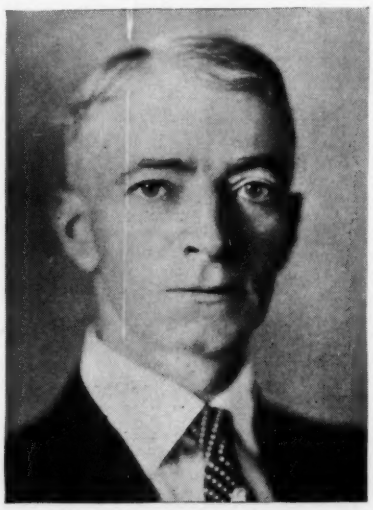
as each of the states has selected a Princess for the pageant of 1925. At the end of the Exposition the Queen for the next year will be chosen from among the Princesses.

There'll Be Fun, Too

Daily entertainment will be furnished on the ground in the Exposition Revue. The management has signed talent from some of the leading theatrical circuits of the East and the programs will be seen daily.

For those given to golf, the annual tournament will come as a welcome event. The tournament this year is in chrage of B. H. Collins, chairman of the golf committee. The tournament is open to men of the industry and its kindred businesses. Suitable prizes and awards will be made at the close of the play.

But the most valuable phase of the Exposition on its semi-social side comes from the opportunity of mingling with men of long acquaintance. There is no word to designate this. But it is truly a "Reunion of Oil Men."



P. D. HAYES
Assistant Treasurer of the Exposition

Close-up of Water Cooling System With Plant in Background

One Gasoline Plant Serves Wortham Field

By A. R. McTee
Staff Representative

RECENT completion of the Humble Oil and Refining Company's new gasoline plant at Wortham gives that field one of the most modern and up-to-date gasoline plants in the country. In addition to taking gas from its own lease at Wortham, the company is buying from all other leases in the field and the plant has been in operation for several weeks. Its maximum capacity is five and one-half million cubic feet of gas, with a possible output of from 10,000 to 12,000 gallons of gasoline.

This plant is one of the few Braun installations in Texas and makes use of the absorption distillation process of extracting gasoline. This method is by far the most popular in North and Central Texas, due to the fact that the gas is comparatively lean. At Wortham, the average yield of gasoline per 1000 cubic feet of gas is two gallons.

Equipment in Use

Equipment in the plan includes the latest developments in gasoline recovery engineering. The total horsepower is 975, generated by gas engines. These include five 80-horsepower Clarks, three 160-horsepower Clarks, an 80-horsepower Foos, and a Troy vertical steam engine.

The Clark engines handle the gas during the process of recovering the gasoline.

The lighting and water systems are taken care of by the Foos engine. This engine is also used as a source of power in any emergency that may arise.

A Goulds triplex pump handles the gasoline, pumping it from the storage tank at the plant to loading racks on the Southern Pacific Railroad, about a half mile away.

Storage capacity for gasoline at the plant is 60,000 gallons.

Mineral seal oil used in the extraction process is handled by a Kinney oil pump, rotary type, direct connected to the vertical Troy steam engine.

Steam is provided by three 66-horsepower boilers.

Water needed for operating the plant is furnished by the production department of the Humble Oil and Refining Company, from nearby leases.

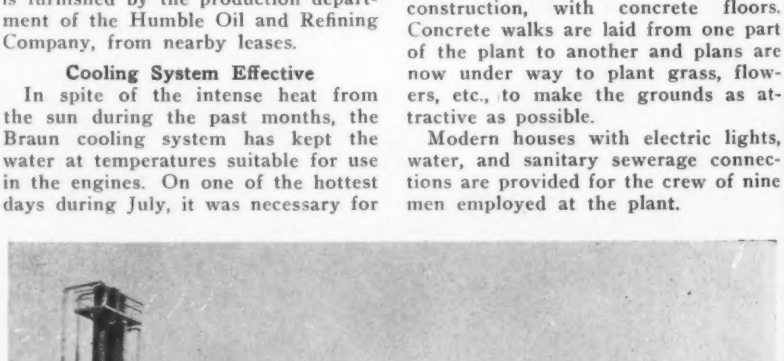
Cooling System Effective

In spite of the intense heat from the sun during the past months, the Braun cooling system has kept the water at temperatures suitable for use in the engines. On one of the hottest days during July, it was necessary for workmen to get into the water to make repairs on a line. The water was so cool that after being in it for some little time, the men were actually uncomfortabe.

All waste steam about the plant is condensed and turned back into the water lines to help conserve the supply of water as much as possible.

Buildings that house the engines and other inside equipment are of all-steel construction, with concrete floors. Concrete walks are laid from one part of the plant to another and plans are now under way to plant grass, flowers, etc., to make the grounds as attractive as possible.

Modern houses with electric lights, water, and sanitary sewerage connections are provided for the crew of nine men employed at the plant.



A View Showing Compactness of Humble Plant at Wortham

Eastern Refiners Discuss Fluctuations in Prices

N. P. A. Sessions at Atlantic City draw complete program on refining and selling oils

Atlantic City, N. J.—Fluctuations in prices of petroleum products are the result of the working of the basic laws of supply and demand. At least that was the common opinion expressed here at the semi-annual meeting of the National Petroleum Association, September 16, 17 and 18.

Expressions to this effect came from a general discussion of prices within the petroleum industry. These opinions were uttered in opposition to frequent statements that a few "bootleggers" bring on price reductions.

Aside from the complete program, the session at Atlantic City was the occasion for filing the annual report of each member of the council of the body as well as each trustee in charge of a department of the association.

This report bears the names of C. D. Chamberlain, general counsel; Fayette B. Dow, Washington counsel; Willis Crane, traffic attorney; Fred W. Boltz, consulting traffic expert; B. B. Stroud, trustee department of manufacture; F. B. Fretter, trustee department of traffic and transportation; E. C. Gardner, trustee department of standards and tests; L. P. Litzinger, trustee department of trade and commerce; P. S. Tarbox, trustee department of economics, accounting and statistics; Sheldon Clark, trustee department of legislation and litigation; Fred G. Clark, trustee department of membership and relations; R. A. Wotowitch, trustee department of welfare and insurance.

O. P. Keeney was re-elected president of the association. Sheldon Clark was re-elected first vice-president. L. P. Litzinger was cohsen second vice-president.

Other officials were re-elected as follows: C. D. Chamberlin, general counsel; Fayette B. Dow, counsel; Willis Crane, traffic attorney; Herberg G. Eaton, recording secretary; G. B. Hunter, treasurer.

The new board of trustees includes Fred G. Clark, Sheldon Clark, F. B. Fretter, L. P. Litzinger, O. P. Keeney, B. B. Stroud, P. S. Tarbox, R. A. Wotowitch, M. R. Singleton, E. M. Lyons, H. A. Logan and A. C. Woodman. Formerly the board included only nine members, the decision to increase to 12 being made at this meeting.

The program followed at the meeting here follows:

Call to order, O. P. Keeney, president.

Reading of minutes, Herbert G. Eaton, recording secretary.

Appointment of nominating committee.

Report of general counsel, C. D. Chamberlin.

Report of treasurer, G. B. Hunter.

General subject, traffic and transportation, report of the department of traffic and transportation, Frank B. Fretter, trustee in charge.

Report of traffic attorney, Willis Crane.

Discussion: General subject, Welfare and Insurance, R. A. Wotowitch, trustee in charge.

Address: "Organizing N. P. A. Fire Marshalls," F. A. Epps, representative of the National Petroleum Association on the committee on Flammable Liquids, National Fire Protection Association.

Remarks: Houston Dunn, secretary National Petroleum Mutual Fire Insurance Company.

Discussion.

SEPTEMBER 17

Report of Nominating Committee, Election of Officers and Trustees.

Vote on proposal to increase the number of trustees from nine to twelve.

General Subject: Manufacture.

Address: "Application of Science to Petroleum Refining." J. F. Oakleaf, Head of the Department of Planning and Research, Vacuum Oil Company, Paulsboro, N. J.

Discussion.

Report of the Department of Manufacture, B. B. Stroud, Trustee in charge.

General Subject: Accounting and Statistics.

Report of the Department of Economics, Accounting and Statistics. P. S. Tarbox, trustee in charge.

General Subject: Standards and Tests.

Report of the Department of Standards and Tests. E. C. Gardner, trustee in charge.

Board of trustees meeting.

THURSDAY AFTERNOON

Golf tournament at Sea View Golf Club. G. G. Woodruff in charge. Ladies are invited.

THURSDAY EVENING

Fellowship dinner, Hotel Traymore. Fred G. Clark in charge of entertainment.

SEPTEMBER 18

General Subject: Trade and Commerce.

Address: "Marketing Problems of the Refiners." Warren C. Platt, editor, National Petroleum News.

Report of Department of Trade and Commerce. L. P. Litzinger, trustee in charge.

Address: "Economic Law Breaking in the Petroleum Refining Industry." Dr. J. E. Pogue, author of "Economics of Petroleum."

Discussion.

General Subject: Legislation and Litigation.

Report of the Department of Legislation and Litigation. Sheldon Clark, trustee in charge.

General Subject: Membership and Relations.

Report of the Department of Membership and Relations. Fred G. Clark, trustee in charge.

"The National Petroleum Association." Discussion by the members.

Remarks, Fayette B. Dow.

Gasoline Committees to Meet During Exposition

Tulsa, Oklahoma.—All committees of the Association of Natural Gasoline Manufacturers will meet here October 5, 6 and 7. The dates have been fixed in conjunction with those of the Congress of the International Petroleum Exposition.

The meetings are scheduled as follows:

October 5

10 a. m.—Tank car committee at association headquarters.

10 a. m.—Sales managers' committee in office of A. F. Garrett, Tidal Oil Company.

11 a. m.—Traffic committee at association headquarters.

October 6

10 a. m.—Gas testing committee, in office of A. J. Schlosser, Barnsdall Oil Company.

10 a. m.—Technical committee, in office of C. F. Barton, Tidal Refining Company.

10 a. m.—Plant operators' committee, at association headquarters.

11 a. m.—Gas residue committee, in office of Lloyd F. Bayer, Tidal Oil Company.

October 7

10 a. m.—Specifications committee, in office of Lloyd F. Bayer, Tidal Oil Company.

10 a. m.—Meters and regulators committee, in office of Ray Short, Prairie Oil and Gas Company.

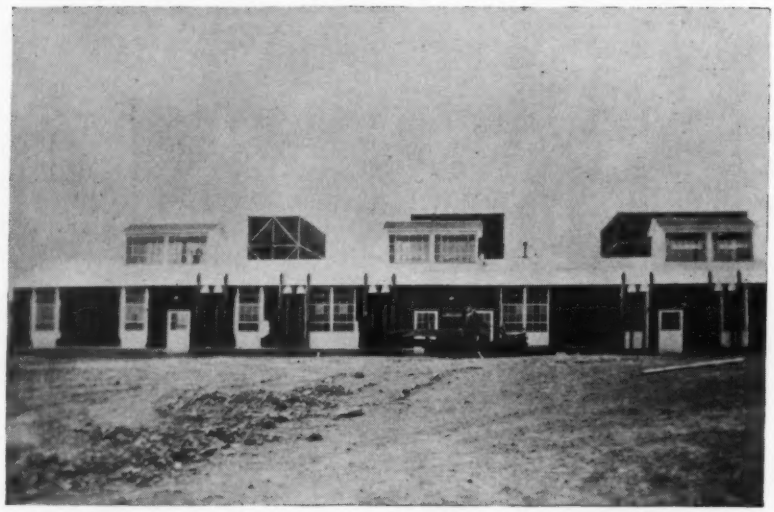
10 a. m.—Gas contract committee, in office of J. H. Boyle, Chestnut & Smith Corporation.

Gasoline Plant and Gas Pump Station Built as One Unit

By Brad Mills
Staff Representative

The New York Oil Company, in building its combination booster and compression plant in the heart of the Teapot Dome oil field, has provided an outlet from large quantities of wet gas which otherwise probably would have remained shut in as a useless potential factor in the industry. The plant ostensibly was built for a booster station but special arrangements, incorporated through the use of new ideas in equipment, have made the plant both a compressor and a pump station for sending the remaining dry gas 40 miles for distribution through the company's mains in the city of Casper.

When the Mammoth Oil Company drilled in the gas wells in the field, they were frowned on, as oil wells were wanted above anything else. The agreement reached between officials of the New York interests and officials of the Mammoth Oil Company, together with the receivers of the company, may eventually mean that the gas wells will be more profitable than the same number of oil wells, since the oil wells generally have proved small.



The New York Oil Company's Combination Compression Plant and Gas Booster Station at Teapot Dome

Main Plant Units

The main units of the plant consist first of three 18 by 20 inch horizontal twin type single acting four cycle Cooper gas engines with 17-inch compressor cylinders. These engines are the low pressure units which pick up the gas from the field gathering lines. on the discharge line. These pressures from five pounds vacuum on the suction line to 40 pounds positive pressure on the discharge line. These pressures seem unusually low but the use of these engines will be noted later in the article.

The second unit of the plant consists of three engines of the same type as described in the foregoing paragraph, with the exception the compressor cylinders, which are nine and one-half inches in diameter. These engines are designed to operate with a maximum intake of 40 pounds and a maximum discharge of 140 pounds. These are the high pressure engines, and while of a low pressure type when compared with engines used in an ordinary compression plant, they are ample for pushing the gas through the second set of coils and on to the city of Casper.

Three Fairbanks-Morse type "800" centrifugal pumps have been installed to provide adequate circulation for the plant. One of these pumps will be used to circulate water through the compressors, one will take care of keeping water in the form of a spray on the internally cooled system of coils and one will remain idle, to be used only in case of emergency. Any of the pumps may be changed instantly to do the work of the other.

Interior of New York Oil Company's Combination Compression Plant and Gas Booster Station at Teapot Dome

Condensing System.

The gas condensing system is very elaborate and consists of two separate units, one to extract as much of the gasoline as possible after the gas leaves the low pressure engines and one for the same purpose after the gas leaves the high pressure engines. The low pressure unit consists of a special Sterling flanged type condenser, 18 sections long by 10 sections wide by 10 sections deep. The high pressure unit is composed of 15,000 feet of two-inch pipe systematically arranged as a system of coils.

The water cooling system is a combination internal and external Sterling flanged type condenser which is 18 sections long by four sections wide by four sections deep. Water sprayed from a Fairbanks-Morse centrifugal pump keeps the condenser at a low temperature.

The knockout tanks are of a special tubular design thoroughly perforated

Plant Men Make Conference Valuable

Skelly Company to get "keymen" together twice a year in the future

Tulsa, Oklahoma.—Success of the first conference of "key men" of the several natural gasoline plants of the Skelly Oil Company has brought a decision to hold similar gatherings twice a year in the future. The first one was held here September 17, an all-day program topped off with a banquet at night.

In the past the Skelly company has had many conferences with only district superintendents and plant superintendents meeting with executives. But the conference just closed went a bit further. District superintendents, plant superintendents, plant chemists and plant clerks were included in the list of those invited to headquarters.

A program had been arranged in advance and it was followed closely. A revelation to executives was the manner in which the men from the plant caught step with the sessions. From the first it was made clear that the session was not for the purpose of criticizing but for the purpose of making it possible for each man to give better work.

How to Order

After the general introduction the topic of purchasing was taken up by F. W. Robertson, purchasing agent of the company. His remarks went into details on the purpose of his department, how it can serve the man at a plant and how a man at the plant can serve it.

Then W. A. Hervey, assistant purchasing agent, got down to cases. He had a number of requisitions, made out in the plants. These he took up in detail, showing where they had been improperly filled out or otherwise improperly used. Between the two speakers, the plant men learned what the functions of the purchasing department are and how the department should be used to assure its proper functioning.

Traffic came next and R. A. Pearce discussed, "The Skelly Tank Line". This included its purpose, reports on car movements and car maintenance.

Loading a Tank Car

Later F. W. McGrath, tank car foreman, took the plant men through a course in the proper loading of a tank car with natural gasoline. He started with the inspection that should be made before a liquid is started into a car, then the method of proper loading and finally the way a car should be sealed and placarded before it leaves the rack.

Under the subject of Sales, G. A. R. Slocum, general sales manager of El Dorado, Kansas, took up the necessity of putting the correct product into a car and then the necessity of loading it out promptly. He discussed his department from the viewpoint of the plant men in his audience.

Two men were heard under the heading of "Claim and Insurance". Paxton Howard outlined his work of securing right of way. C. L. Swim went into the subject of accident reports and insurance.

After lunch, the conference met for an address by W. G. Skelly, president of the company. He discussed the company and its relation to its employees.

Woman Tells 'Em

Under the subject of "Legal", J. T. Dickerson was heard on cases of malicious prosecution, garnishments and the like. The question of tapping gas and gasoline lines was discussed.

Mrs. Ella Tumulty was chosen to represent the treasury department on the program. After general remarks she discussed "The Significance of Drafts."

Both H. G. Humphreys, general auditor; and T. R. Goebel, assistant, were heard on general remarks under the heading of "Accounting". Then came specific subjects, Miss Clara Gartman discussing "Stocks and Shipments"; V. H. Brown, "Material Issues and Transfers"; C. B. Smith, "Payrolls" and C. T. Wingfield, "Pink Copies of Purchases".

The tone of the remarks of O. J. Berend on the subject of "Contracts", was that of giving service.

Cold Weather Talk

Perhaps the most beneficial time spent in the program came under the departmental discussion of the natural gasoline department. "Winter Suggestions" were taken up and each man present was asked to offer some suggestion for assuring better prdouction in cold weather. This session resulted in many valuable suggestions being made by the plant men.

John J. Thomas of the natural gasoline department presided over the conference session.

For the banquet Emry Kaye, superintendent of the natural gasoline department was toastmaster.

The speakers were W. G. Skelly, president; C. C. Herndon, vice president; H. M. Stalcup, vice president; W. P. Z. German, general attorney; H. G. Humphreys, auditor; F. W. Robertson, purchasing agent; E. T. Hopp, treasurer; G. A. R. Slocum, sales manager; and O. J. Berend of the contract department.

Those in from the plants included: A. I. Sellers, O. H. Clement, W. H. Bremerkamp, F. A. Green, R. L. Huntington, C. H. Johnson, J. L. Cline, A. H. Menuet, J. W. Vaiden, J. W. Mooney, C. H. Brannon, A. Steinbacher, L. H. Adair, H. S. Wilson, A. C. Sturgis, L. E. McCullough, H. K. White, J. F. Cronin, E. L. Moon, W. G. Watkins, A. Lucas, J. L. Griffin, H. L. Jackson.

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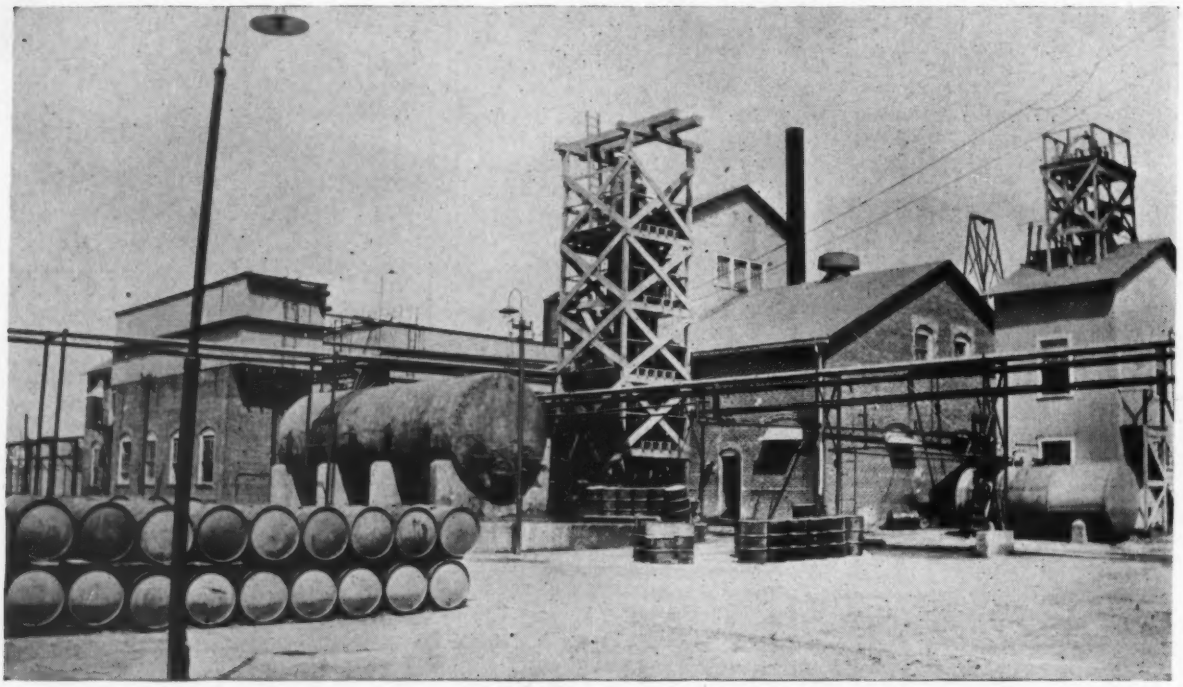
with tubing to insure the proper circulation. They are used after the gas has gone through both the low and high pressure condensers.

The building housing the plant is 146 feet in length by 32 feet in width and is of all-steel construction. It was erected by the Truscon Steel Company and has a very high salvage value.

Flow Chart

The gas will not come directly from the wells to the compressor, but from the traps at the various batteries. It will be picked up by the 10-inch field gathering lines and sent to the compressor engines at approximately two pounds pressure. The low pressure engines will take it from the gathering lines and send it to the primary condensers at a pressure of about 35 pounds. From the primary condensers the gas will pass through the first series of knock-out tanks, where it will be thoroughly broken up. Here the first gasoline will be drawn. From the first knock-out tanks the gas will be drawn into the high pressure compressors at a pressure approximately two pounds less than when it left the low pressure engines. The high pressure engines will send the gas on its way to the high pressure condensing coils at a pressure of not more than 140 pounds. The elaborate system of two-inch coils will receive the gas and take as much gasoline as possible from it. From these coils the gas finally will pass to another series of knock-out tanks, where it will again be broken up. From these tanks the gasoline will be taken as from the first series of tanks. After leaving the last tank, the remaining dry gas will be pumped to Casper.

The exact amount of gas the station will handle has not been determined but the law of supply and demand in this district will be the chief deciding factor.



Alcohol Plant for the Production of Secondary Alcohol From Cracking Still Gasses, Located at the Okmulgee, Oklahoma, Plant of the Empire Refineries, Inc.

Oil a Source of Raw Material for Chemical Industries

By Joe E. Meyer

IN AN address delivered at the society's annual dinner in Los Angeles, California, during the early part of August, Dr. James F. Norris, president of the American Chemical Society, urged noted scientists of that body to "center their attention on the many fascinating problems awaiting solution in the field of petroleum chemistry."

In the course of his address Doctor Norris declared that a united attack by industrial chemists and laboratory workers will bring startling secrets from the compounds of petroleum.

"We are producers of vast quantities of petroleum products," he said. "We have an opportunity to develop great chemical industries based on abundant raw material yet we use this possible source of untold riches only to move us from place to place. I believe petroleum offers the same amazing possibilities as did coal tar. By cracking the crude oil we can make hundreds of compounds soluble as sources for myriads of products. I am not suggesting that anyone try to make a fortune from petroleum, but that the many scientific problems pushing forward for study be approached in the same spirit that finally led to the triumphs attained in aromatic chemistry."

Aromatic Hydrocarbons

The production of aromatic hydrocarbons from petroleum on a commercial scale was first accomplished by the United States Bureau of Mines and the Aetna Explosives Company in 1915, utilizing the Rittman process.

The industrial uses of aromatic hydrocarbons need little comment. The importance of an adequate supply of aromatic hydrocarbons, particularly benzene, toluene, xylene, anthracene and naphthalene, was brought prominently to public attention during 1916 through the serious handicap that the European war placed on American textile manufacturers in the matter of procuring adequate supplies of dyestuffs. Aromatic hydrocarbons are also the source of chemicals important in photography and of valuable medicinal preparations, not to mention the great commercial value of some of these hydrocarbons as basic material in the manufacture of high explosives such as trinitrotoluene (TNT).

While it has long been known that aromatic hydrocarbons can be produced from certain types of petroleum, it had never been established prior to the experiments conducted by Dr. W. F. Rittman while chemical engineer for the Bureau of Mines, that aromatic hydrocarbons can be produced in considerable quantities from any type of oil, whether the oil has asphaltic, or a mixed base, or whether it contains appreciable or slight quantities of naphthene or nitrogen, or any other constituent.

Doctor Rittman and his associates demonstrated that the type of oil selected for treatment is of relatively little importance as compared with the control conditions and this has been verified in operations on a large scale.

Announcement of the discovery of Doctor Rittman was made by the Secretary of the Interior in March, 1915. Following this announcement a public demonstration of the operation of the process was given in the laboratory of the department of engineering chemistry, Columbia University, New York. Following the announcement made in March, 1915, an offer to co-operate in the commercial development of the benzene-toluene process was submitted by the Aetna Explosives Company of New York.

Process Perfected

The proposal of the Aetna Explo-

sives Company to co-operate with the Bureau of Mines in demonstrating the commercial practicability of the benzene-toluene process was accepted and a contract entered into whereby the Aetna company pledged itself to the expenditure of not less than $200,000 in the development of the process.

Under the terms of the agreement with the Aetna Explosives Company, the work incident to the development of the benzene-toluene process on a commercial scale was begun at Pittsburgh, Penn. Extending over a period of seven months, point experimentation and construction was carried on by the Bureau of Mines and the Aetna company. At the termination of this period the Department of the Interior, in whom the administration of the patents covering the process was vested, was advised that the plants were completed for the production of explosives from benzene-toluene by the process of cracking petroleum in the vapor phase.

The following tabular statement of yields as given by the Bureau of Mines in Bulletin 114 is given here for the purpose of showing more clearly the results accomplished. These figures are based upon information and experience acquired during more than six months experimentation and development. They are conservative if efficient means of condensation are employed and if the gases after leaving the condenser are washed or scrubbed. The figures are for a single-stage operation only, and do not take into consideration the total yields that might be obtained if the residuum above the limit of the benzene-toluene cut was re-run. The tables follow:

Total quantity of products recoverable by means of the benzene-Toluene process per day, in a unit plant of 10 single-tube furnaces (tubes 8 inches in diameter by 11½ feet in length) at a rate of oil feed of 15 gallons per hour.

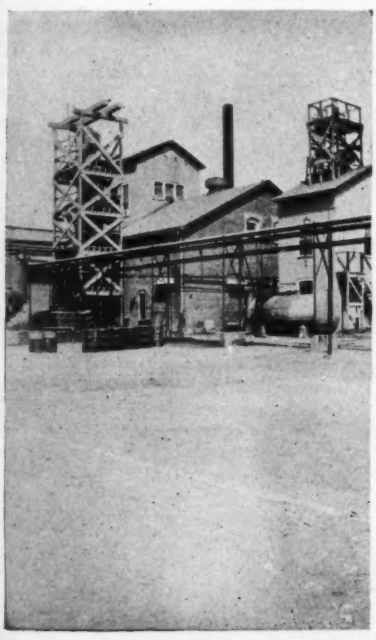
	Gallons
Oil consumption per day (20 hours)	3,000
Recovered oil per day (35 to 50 per cent of original oil):	
Benzene recovered (6 to 8 per cent of original oil)	180
Toluene recovered (6 to 8 per cent of original oil)	180
Xylenes recovered (4 to 6 per cent of original oil)	120
Gasoline recovered (6 to 8 per cent of original oil)	180
Creosote oil and pitch (a) (25 to 35 per cent of original oil)	340
Total	1,050
Carbon produced per day (3 to 5 per cent of original oil) (b)	150
Gas produced per day (45 to 60 per cent of original oil) (c)	1,800
Total recovered oil, carbon and gas	3,000

(a) Includes higher aromatics, such as cymene, dipshnyl, naphthalene, anthracene, also valuable lubricating oil.

(b) 1,200 pounds.

(c) 120,000 cubic feet.

The results of the large scale operation leave little doubt as to the success of the benzene-toluene process on a commercially operative scale. It has been proved that benzene and toluene can be produced from petroleum by this process in large quantities. The products produced were worked into nitro-compounds for making explosives and the nitro derivatives, or the derivitives possible thereof, are likewise suitable for utilization in the production of dyestuffs. It follows that the successful large-scale development of such process is a source of national security, and in view of our extensive petroleum resources, the United States could be independent of foreign sources for our supplies of the aromatic bases for the production of the most efficient military explosives.

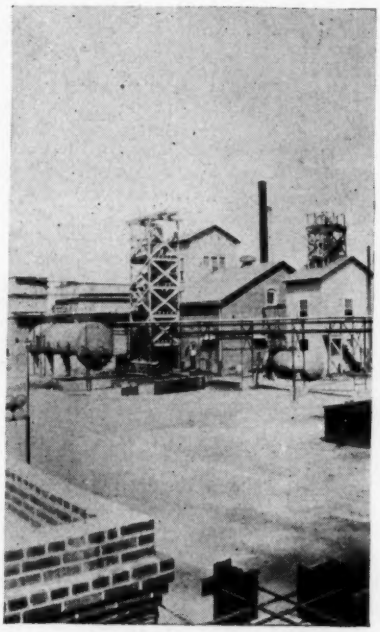


Arrangement of Alcohol Plant at Empire Plant

Production of Secondary Alcohols

The development of processes for the production of secondary alcohols from petroleum marks a decisive forward step in petroleum chemistry and brings to the attention of the oil industry the multitudinous possibilities in this great undeveloped field for acquirement of new and valuable commercial products from petroleum as a base.

Recovery of isopropyl, and secondary butyl, amyl, hexyl, heptyl and octyle alcohols in commercial quantities from cracking still gases is now an accomplished fact in two petroleum alcohol plants at present in operation in this country. The largest plant now operating is that of the Bayway refinery of the Standard Oil Company of New Jersey. Another plant operating under the same or similar processes



Another View of Alcohol Plant at Empire Refinery

and under special arrangement, is located at the Okmulgee, Oklahoma, refinery of the Empire Refineries, Incorporated. Research conducted separately by each company resulted in development of similar successful commercial processes and a manufacturing agreement was entered into.

The present process in use at the two plants mentioned was discovered by Carleton Ellis, also the inventor of certain hydrogenation processes, which are also of great importance to the petroleum industry. This process discovered by Ellis, secured by United States patent, is now owned by the Standard Oil Company of New Jersey.

The production of isopropyl, and secondary butyl, amyl, hexyl, heptyl and octyl alcohols, from waste still gases, is based on the reactivity of the olefin content of the latter with sulphuric acid. Ethylene, propylene, butylene, amylene and the like are all present in waste still gases, in quantities varying from a trace to appreciable percentages. The pyrolytic decomposition of mineral oils at elevated temperatures seems to favor the production of a particularly large percentage of propylene however. The olefins formed by the pyrolytic decomposition of mineral oils combine with sulphuric acid of proper strength to form alkyl acid esters (propyl sulphuric acid), in accordance with the reaction:

$$\begin{array}{l} CH_3 \\ | \\ CH(HSO_4) \\ | \\ CH_2 \end{array} + H_2O = \begin{array}{l} CH_3 \\ | \\ CH(HSO_4) \\ | \\ CH_2 \end{array}$$

When such acid esters are treated with water, isopropyl alcohol is formed. The alcohol present may be separated by distillation from the acid and polymers also present. Hydrolysis

of the alkyl acid esters is indicated in the following reaction:

$$\begin{array}{l} CH_3 \\ | \\ CH(HSO_4)+H_2O=CHOH+H_2SO_4 \\ | \\ CH_3 \end{array} \qquad \begin{array}{l} CH_3 \\ | \\ \\ | \\ CH_3 \end{array}$$

As mentioned hereinbefore the gases which are used for the manufacture of the alcohols contain a mixture of olefins from which isopropyl, and secondary butyl, amyl, hexyl, heptyl, and octyl alcohols are obtained. The various alcohols are produced in decreasing proportions following the order previously stated. While ethylene is present to the extent of several per cent in gases from cracking stills, there is no evidence of the formation of ethyl alcohol under present conditions of operation. The absorption of ethylene requires sulphuric acid of high concentration, and high temperatures are necessary.

Physical Characteristics of Secondary Alcohols Now Available in Commercial Quantities and Produced from Petroleum.

Rectified isopropyl alcohol is obtained as a constant boiling mixture containing 91 per cent of alcohol and 9 per cent of water by volume. The boiling point of this alcohol-water mixture is 80.4 degrees Centigrade and the specific gravity at 20°/4° Centigrade is 0.816. Dehydration of this mixture is effected by a short digestion with an excess of caustic soda. A practically anyhydrous alcohol is obtained on distillation which has a boiling point of 82.4 degrees centigrade and a specific gravity of 0.785 at 20°/4° Centigrade. Like normal propyl alcohol, isopropyl alcohol is miscible in all proportions with water, and for solvent use the difference between normal propyl and isopropyl alcohol is unimportant. Isopropyl alcohol as now marketed is a colorless, agreeable-smelling liquid, having a somewhat bitter taste.

Secondary butyl alcohol is now available in commercial quantities at a very reasonable price. Until a short time ago this alcohol was known only as a rare laboratory chemical.

From the residue remaining after the isopropyl alcohol and water mixture have distilled over, the secondary butyl alcohol, if sufficient water is present, distils over as a constant boiling mixture with water at 87.5 degrees Centigrade.

This azeotropic mixture was discovered by Mann and Lebo in the alcohol plant of the Standard Oil Company of New Jersey, in their Bayway refinery.

This constant boiling mixture of secondary butyl alcohol and water was found to boil at a constant temperature of 87.5 degrees Centigrade and 760 mm. The specific gravity of the mixture is 0.8620 at 20°/4° Centigrade and it contains 72.2 per cent of alcohol by weight and 77.72 per cent by volume.

Secondary butyl alcohol as now marketed contains from 98.5 per cent to 100 per cent alcohol by volume. This nearly anhydrous product is obtained by dehydrating the azeotropic mixture of secondary butyl alcohol and water with sodium hydroxide and then distilling.

Secondary amyl alcohol as now marketed contains 99 per cent to 100 per cent alcohol by volume. The pure product has a boiling point of 119.2 degrees Centigrade at 760 mm. and specific gravity of 0.8088 at 20°/4° Centigrade.

Secondary hexyl, heptyl, and octyl alcohols have been prepared in small quantities from petroleum and development of processes for their recovery in quantities sufficient for commercial utilization are now past the initial stage of development in several research organizations in this country.

The Antiseptic, Bacteriological and Pharmocological Properties of Isopropyl Alcohol.

The valuable antiseptic and bactericidal properties of isopropyl alcohol have led to its introduction as a surgical antiseptic.

Bacteriological investigations have shown the germicidal power of isopropyl alcohol to be approximately twice that of ethyl alcohol. Its behavior toward staphylococcus aureus, bacillus anthacis, bacillus subtilis, bacillus coli, and the ecetifying organisms bacterium kutzingianum and bacterium pasteurianus has been investigated. In concentrations of 30 to 50 per cent, moist staphylococci are killed in one minute, and dried staphylococci and dried anthrax bacilli are killed in two to five minutes. Bacillus coli and bacillus subtilis are affected in the same manner. Three to six per cent solutions of isopropyl alcohol effect inhibition of bacterial growth of the organisms investigated, and in the case of acetifying organisms their growth is completely inhibited by a one per cent solution of the alcohol.

Investigations pertaining to the pharmacology of isopropyl alcohol have shown its effect an the skin to be exactly similar to that of ethyl alcohol. When it is injected intravenously its toxic effect is twice as great as that of ethyl alcohol, but it appears to be much less injurious with respect to inhalation of vapors than either ethyl (grain) or methyl (wood) alcohol, a property which is of great value in respect to the industrial use of the alcohol. Taken internally, in doses as large as 25 cubic centimeters, it has failed to produce harmful effects, other than a temporary depression. No exhilerating action similar to that produced by ethyl alcohol is brought about by taking isopropyl alcohol internally and consequently no incentive is offered to its use for beverage purposes. As a consequence it may be marketed free from denaturants, and is free from taxes and other restrictive meatures.

Industrial Uses

Industrially the alcohols described are most important as solvents. They are readily converted into nitro-cellulose solvents for which a steadily increasing demand is being created by the rapidly extending use of new finishes such as Duco. The use of these alcohols as solvents while important industrially is not the only field for their use. It is apparent to the organic chemist that the availability of these hitherto very rare alcohols offers great possibilities for their use in organic syntheses.

The availability of these alcohols furnishes the organic chemist with raw materials for the synthesis of a wide range of organic compounds, and several derivatives have already been prepared by the experimental laboratories of the Standard Oil Company of New Jersey at their Bayway plant. A brief description of several of these derivatives may be of interest.

Azeotropic Mixture of Isopropyl Alcohol and Isopropyl Acetate: This constant boiling mixture consisting of 52.3 per cent isopropyl alcohol and 47.7 per cent isopropyl acetate by weight and having a boiling point of 80.1 degrees Centigrade at 760 mm. was first described by W. W. Clough and Carl O. Johns of the Standard Oil Company of New Jersey. It has a pleasant odor and is an excellent solvent for many organic compounds.

Isopropyl Chloride: This derivative is easily prepared by slowly distilling a mixture of isopropyl alcohol and concentrated aqueous hydrochloric acid. It is an excellent solvent for fats, and when ignited it burns slowly, offering no objections in this respect as the flame is easily extinguished.

Secondary Butyl Chloride: This derivative is prepared in a manner similar to that employed for the preparation of isopropyl chloride just described. It has a pleasant odor and is a good solvent for fats and waxes.

Secondary Amyl Chloride: This derivative is prepared in a manner similar to that employed for the preparation of isopropyl chloride and secondary butyl chloride. The odor of secondary amyl chloride is sweet and it is a good solvent for fats and waxes.

The foundations on which the solvent industry are based are in process of shifting. Expensive primary amyl alcohols were but a short time ago replaced by butanol produced from corn by a relatively cheap process. Secondary amyl alcohols and many others now possible to produce more cheaply from petroleum bid fair to replace butanol. The production of alcohols from petroleum is but one example of the multitude of potential values that might be developed to great advantage in the failing resource of the petroleum industry.

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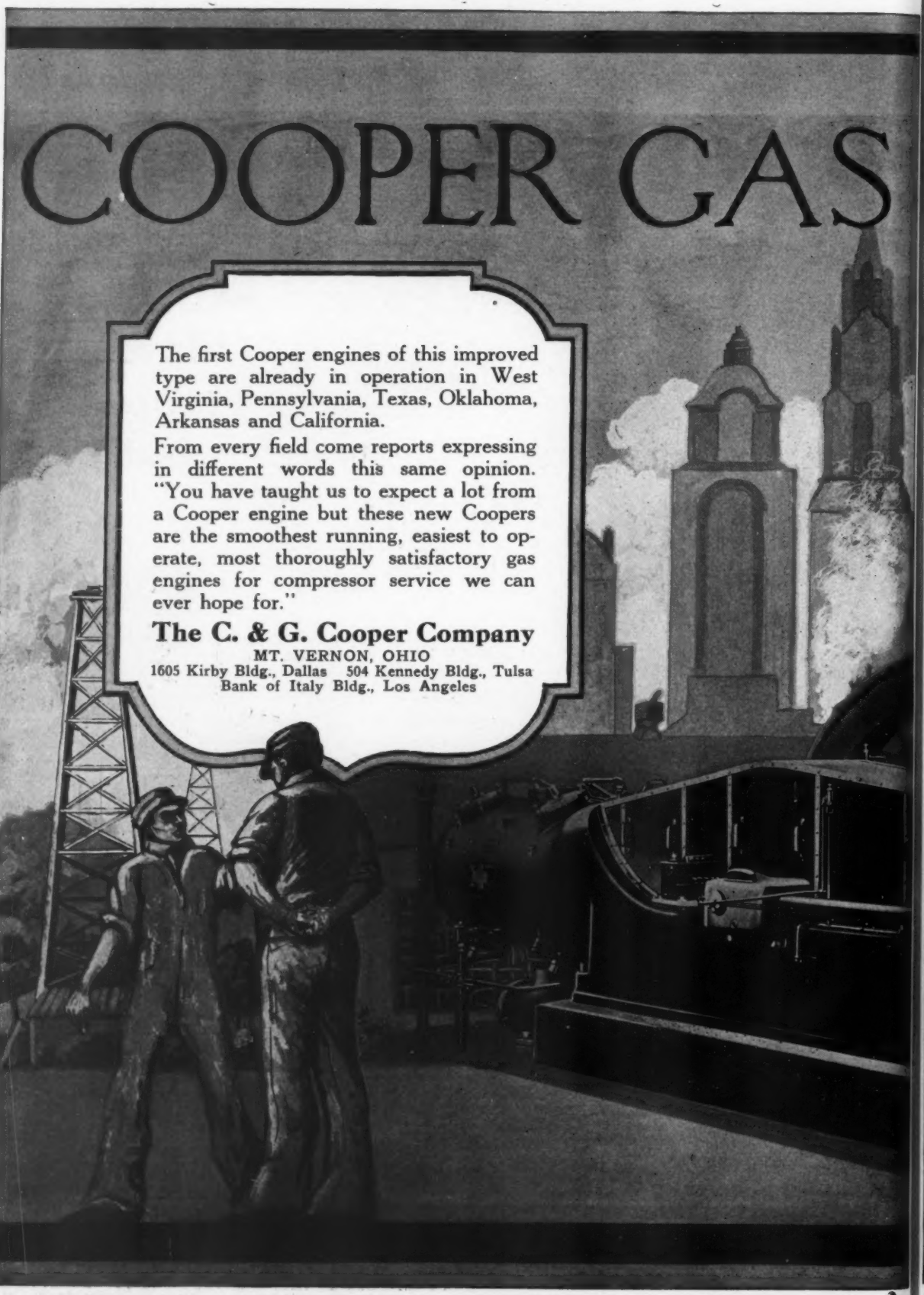
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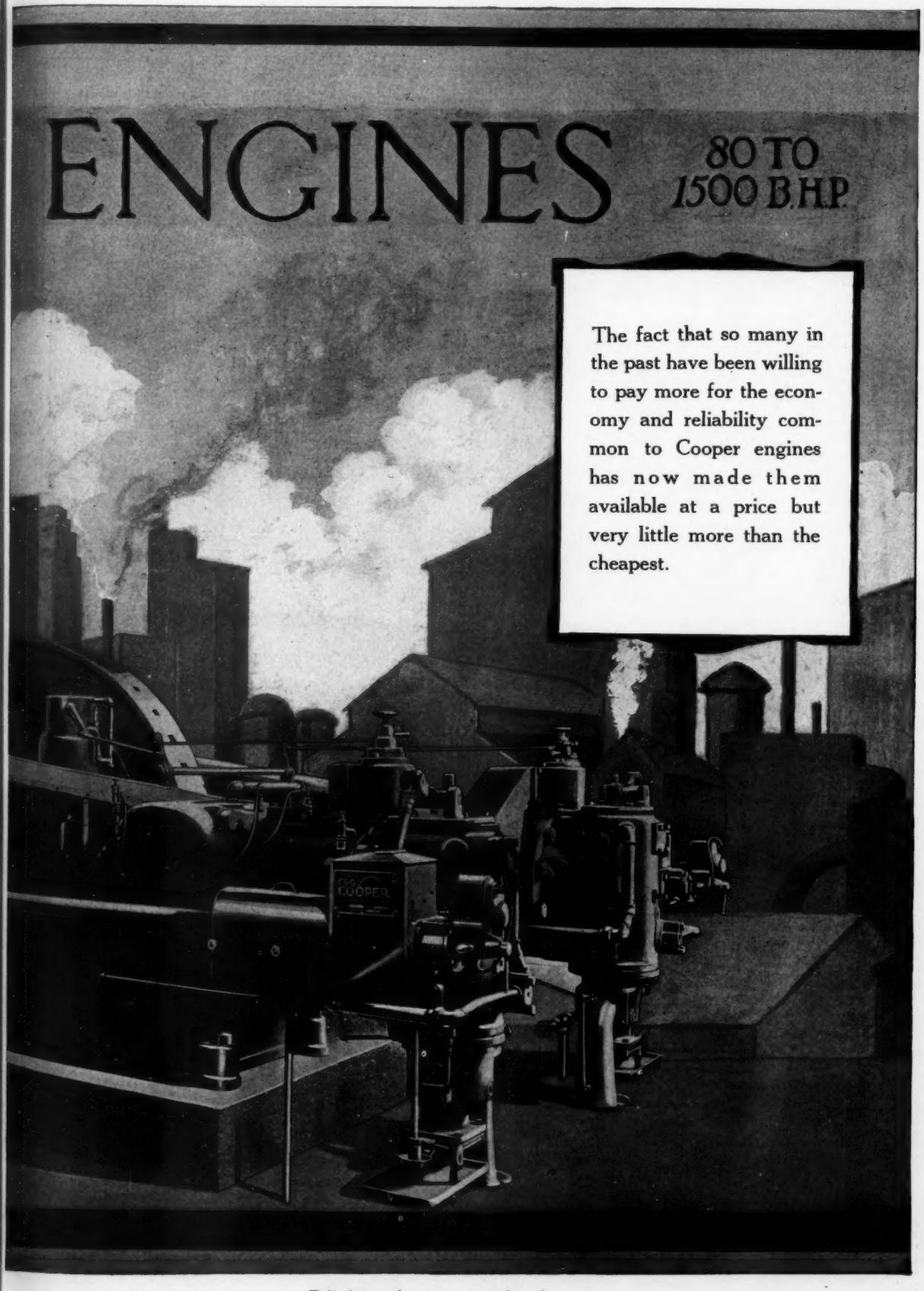
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of new commercial products from petroleum as a base is that of Arthur D. Little, Incorporated. For the past three years the organization of Arthur D. Little, Incorporated, has been concentrating its entire technical organization on the fundamental chemistry of petroleum hydrocarbons in an effort to develop new products. The announcement of the successful result of this effort follows:

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"Instead of the large proportion of low priced fuel oil produced in other cracking processes, the new process, upon which this development is based, designedly yields a large volume of gas remarkably rich in olefines and other reactive hydrocarbons, for the treatment of which special processes have been developed, which produce therefrom isopropyl alcohol along with several butyl, amyl and hexyl alcohols in quantities having a value at present market prices of over $9 per barrel of oil processed in the semi-commercial plant now in operation.

"The alcohols themselves serve, moreover, as intermediates from which an extensive line of secondary products and special solvents may be prepared. The new alcohols are readily converted into nitro-cellulose solvents, and as such are available for those new types of varnishes and finishes which are coming into such rapidly extending use in the furniture and automobile industries."

Results of such far-reaching influence are now a matter of achievement by science in its rapid advances that no industry can hope to ignore research and survive.

The petroleum industry has unsolved scientific problems, without number, but the expenditure per barrel of oil produced, for research and for the development of the enormous possibilities in new commercial products from petroleum as a basic material, will come to but a very small fraction of a cent.

What to Do When the Engine Stops

THE question "What to do when the engine stops" warrants careful consideration. It is a challenge to the engineer operating a gas engine to stop and think in order to bring about an intelligent solution of what caused the engine to stop. In the operation of engines at gasoline plants, when an engine is down it is important to start it quickly and many times an engine is started with the cause of shut down unknown and unsolved, thus paving the way for recurrence of the same trouble.

The gas engine derives its power from the expansion of an ignited charge of gas and air mixture confined in combustion chamber while under compression, it follows then, that we must keep these factors in mind and where the trouble may be due to ignition, which appears first in thought, we still must not ignore the other factors and when all is said and done there are only three.

In discussing these factors, it would be best to classify them as circuits, so that we can visualize them from their start to finish, as a thorough knowledge of each circuit helps in solving the trouble.

Air First

First, we have the air circuit. The air mixes with the gas when it is drawn into combustion chamber on suction stroke of piston, the mixing valve, nearly all types, is actuated by means of plates on springs, at least some arrangement whereby the valve can close by overcoming effect of suction stroke of piston. This air valve or mixing valve causes much trouble, its working parts become worn out or worn to the extent of causing lost motion, it may become clogged up with dirt and oil causing subsequent troubles.

THINK!

Somebody once made a crack about a man being worth $3 a day from his neck down but from his neck up—well, there is no limit on his value.

It's that way around a gasoline plant. Otto Peters, who does a lot of thinking as well as a lot of work, says the stopping of an engine "is a challenge to the engineer operating the gas engine to stop and think."

His paper is just a little insight into what should be done when trouble comes along with the engines.—The Editor.

Next Gas

Second, we have the gas circuit. The pressure maintained on the gas header affects the operation of the engine, particularly when it is one of several on the same gas header.

Then Ignition

Third, we have the ignition circuit. This involves the magneto and of course in this circuit there are many troubles, the most frequent troubles lay in the spark plug, ignition cable and breaker box contact points. The spark plug trouble may be due to improper point adjustment, worn out points or be short-circuited within itself, the cable may cause trouble due to weakened insulation, frayed ends at spark plug, or loosely connected at ends. The breaker box points cause trouble due to improper adjustment, worn out parts or movable parts sticking.

Some Study

Of these three circuits, namely, air, gas and ignition, we have in mind they are the fundamentals, of these we must stress the importance of ignition circuit, and it is imperative that engineers study ignition. While there are different types of magnetoes the working principle is practically the same, the difference being in construction.

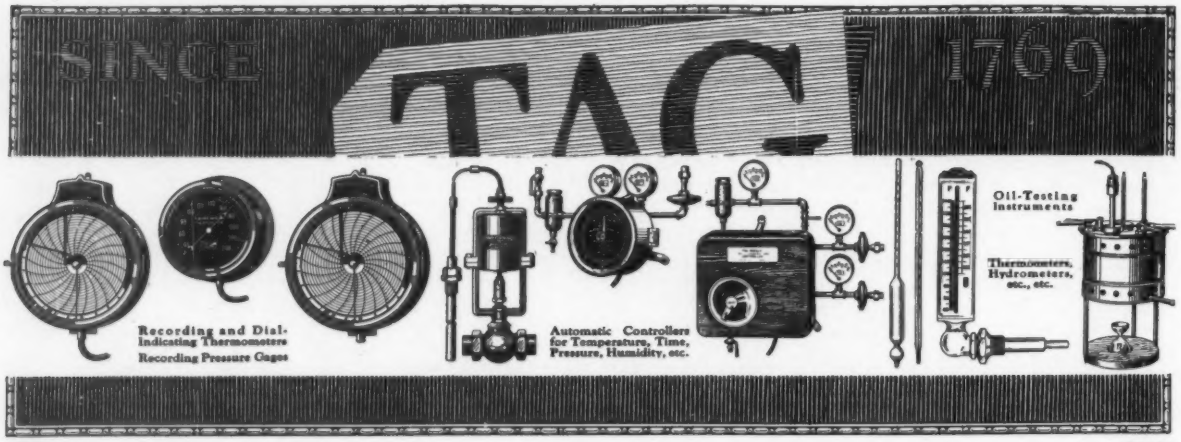
Magnetism

To understand ignition we must study magnetism, it is an interesting study because magnetism is the fundamental principle of operation for electrical devices and knowing how important it is for us as engineers to understand ignition its study should not be neglected, because without a knowledge of it we cannot intelligently repair an electrical device, especially one that is governed by magnetism.

Hands Off

It may interest you to know how and why a magneto develops thousands of volts with a fractional amount of amperage, it is also interesting to know the properties of a magnet, but it is also mighty good to know when to let the magneto alone.

E. P. Canepa, chemical engineer and manager of a 14,000 barrel refinery of the Argentine government at La Plata, is visiting in California.



ser'vice, *n.* **1.** The act of serving; labor performed in the interest of . . others; . . as, willing *service.* **2.** Any work done for the benefit of another; the act of helping another, . . a benefit or advantage conferred, . . as, . . do me a *service.* . . **8.** An agency for the accomplishment of some constantly needed work, or the supply of some general and recurrent demand; as, a good telephone *service.*

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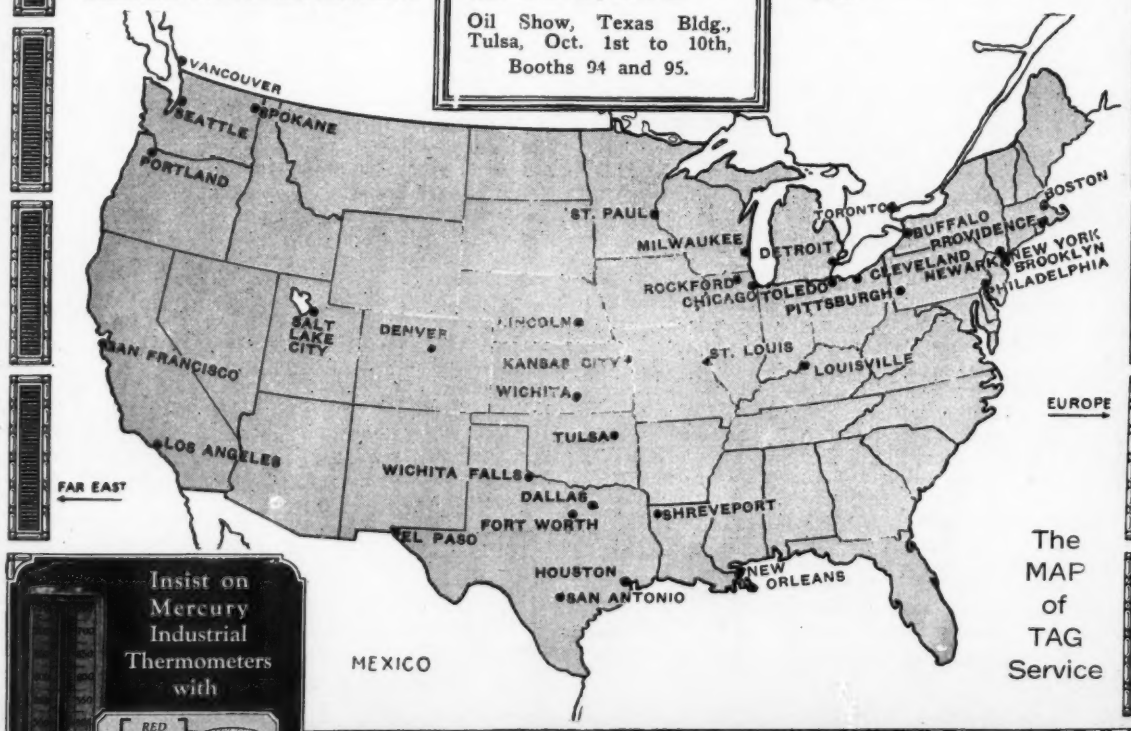
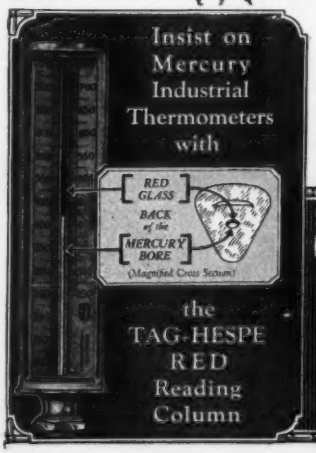


The MAP of TAG Service



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Prevention of Evaporation Losses From Gasoline Storage

By R. E. Wilson, H. V. Atwell, E. P. Brown and G. W. Chenicek

Standard Oil Company (Indiana) Whiting, Ind.

THE serious magnitude of the loss by evaporation of petroleum fractions during storage and handling was first investigated quantitatively by Wiggins,[2] who showed that the lightest and most valuable fractions of crude oil to the extent of 6 or 7 per cent are commonly lost by evaporation between the well and the refinery. Later reports by Wiggins[3] and Schmidt[4] point out various methods for reducing these losses. Other investigators,[5] interested in some particular device for preventing evaporation, have also gathered valuable data, confirming the conclusion of Wiggins. Most of this work has been done on crude oil, although Schmidt studied the evaporation of gasoline from 250 and 500 barrel storage tanks. However, since it is the gasoline fraction that evaporates from crude oil, an even greater rate of loss would be expected in the refinery storage of finished gasoline.

For two seasons this laboratory has been studying the losses from eleven 120×40 foot gasoline storage tanks (holding about 67,000 50-gallon barrels) at the Whiting Refinery, trying out a number of new devices for reducing these losses. The best of these appears to be the so-called "breather bag" or "balloon," a new and surprisingly effective means of stopping the breathing loss. This paper deals with the development of the breather bags and the results of their application to several gasoline storage tanks.

SYNOPSIS

The loss of gasoline from storage tanks with roofs tight enough to keep out the wind is due almost entirely to the daily breathing out of gasoline-saturated air as the temperature increases. Various methods for preventing this evaporation loss have been tried, but the most satisfactory means of saving the exhaled vapors seems to be the breather bags developed by this laboratory in 1923.

Careful weekly gaugings made from March to November, 1924, show that these bags reduced the average monthly evaporation loss during this entire period from 0.25 to 0.04 per cent of the tank contents, or a saving of 6900 gallons per tank per month. Strength and other tests on balloons and fabric in use for 22 months show no appreciable deterioration. The average life of the balloons will certainly not be under four years in this climate, and a much longer life seems quite probable.

Cost data and suggestions for other possible applications of these breather bags are given.

Breathing of Storage Tanks

The vapor in an average storage tank is at practically constant temperature every night for several hours just preceding sunrise, during which time equilibrium is substantially reached between the liquid gasoline and the vapor. As the temperature of the vapor rises during the daytime the saturated mixture expands, part of it being displaced through the vent or breather pipe. At the same time the temperature and vapor pressure of the surface layer of gasoline rise rather rapidly, causing a further evaporation thereof, and a corresponding displacement of the overlying vapor will take place in addition to the displacement due to simple thermal expansion. Most of the previous investigators of the subject have entirely overlooked the latter cause of breathing, which is really the largest factor, and have calculated that the volume of gas expelled by thermal expansion is comparatively small and could scarcely account for the observed losses.

As the vapor and oil surface cool off during the afternoon and evening this process is reversed, gasoline vapor being condensed into the liquid and the whole vapor volume shrinking as its temperature falls. To maintain atmospheric pressure within the tank, fresh air is sucked in from outside and is saturated with gasoline vapor before morning. This periodic exhaling of mixed vapors and inhaling of fresh air due to temperature fluctuations is known as breathing.

The loss of gasoline due to such breathing can be calculated only by making numerous assumptions as indicated in the following example. This calculation is based on temperature changes which have been found typical of an average clear summer day at Whiting. The loss is figured per 1000 cubic feet of vapor space so that it can be applied to any tank undergoing the same temperature change. A constant barometric pressure of 750 mm. of mercury is assumed. Figure 1 is an approximate vapor pressure curve for Red Crown gasoline, which is used for this calculation.

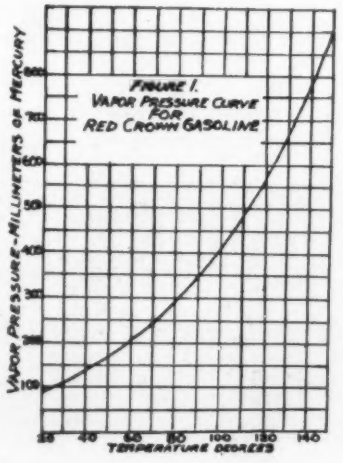

FIGURE 1. VAPOR PRESSURE CURVE FOR RED CROWN GASOLINE

Note—It will be noticed that this curve indicates a boiling point (vapor pressure 760 mm.) of 145° F., whereas a regular A. S. T. M. distillation test gives a figure of about 100° F. This is determined, however, with the thermometer in the vapor, and really measures the temperature of condensation of the lightest ends in the gasoline If another thermometer is placed in the liquid at the same time it shows a true boiling point in the ordinary sense 40 to 70 degrees higher than that indicated by the thermometer in the vapor.

Assuming that at night the surface temperature of the gasoline and the vapor above it reach equilibrium at 75° F., where the gasoline has a vapor pressure of 185 mm., then the pounds of air per 100 cubic feet of vapor mixture will be:

$$\text{Air} = 1000 \times \frac{29}{359} \times \frac{750-185}{750} \times \frac{492}{760} \times \frac{}{535} = 55.2 \text{ lbs.}$$

At the hottest part of the day the max-

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[2]Reprinted from the October, 1925, number of Industrial and Engineering Chemistry and presented before the Petroleum Division of the American Chemical Society at the seventieth annual meeting in Los Angeles, August 3 to 8, 1925.

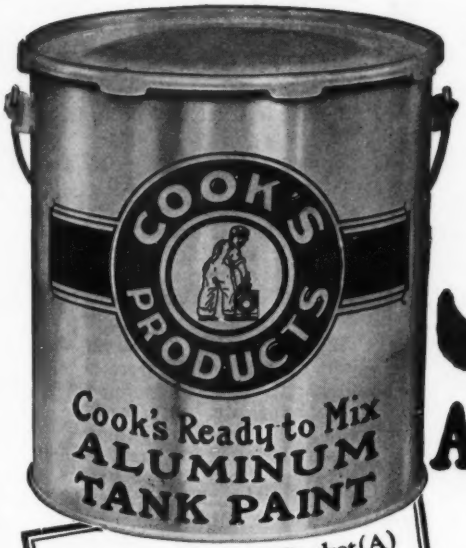
Remembering that the molecular weight of a gas in pounds always occupies substantially 359 cubic feet under standard conditions.

[2]Bur. Mines, Bull., 200 (1922).

[3]Ibid., Bur. Tech. Paper, 319 (1922).

[4]Ibid., Repts. Investigations, 2531 (1923).

[5]Johns Manville Co., Catalog: "J-M Vapor Tight Insulated Tank Top." 1923.



Cook has pioneered again, this time with a

fresh

READY-TO-MIX ALUMINUM TANK PAINT

Now, in this *new* and *unique* package, you may buy Aluminum Tank Paint that is sure to be *fresh.* Because it *is* fresh, it has greater "leafing power", it wears better, and it reflects light and heat most effectively.

Science has proved that Aluminum Paint, to be most effective, must be applied when freshly mixed. It has remained for the Cook Paint and Varnish Company, pioneers in the manufacture of paints for the oil industry, to devise a paint package which assures *easy and foolproof mixing.*

When you use Cook's Aluminum Tank Paint, you get Liquid and Powder in exactly the right proportions, ready to mix. It is bright, shiny, *new* paint—with a covering capacity of 750 square feet to the gallon. The greater leafing power of the fresh Aluminum "seals in" the paint, giving maximum wear and maximum heat reflection. One coat will do the work. It may be applied with either brush or spray.

As an undercoat, use Cook's Rust Inhibitive Primer. It prepares the surface so that less Aluminum Paint is required; and firmly anchors paint to metal.

For dado work on tanks, use Cook's Steel-Kote, the toughest paint film known. It spreads farthest, covers better, wears longer. Preserves steel and prevents rust.

Powder in the Small Bucket (A) Liquid in the Large Bucket (B) Together in a 5-Gallon Package

The large bucket "B" contains the Liquid and a separate bucket "A" which contains the Aluminum Powder. Remove the lid of the large bucket and take out the smaller Bucket containing Powder. Cut out the soft tin top of Bucket "A" and dump the Powder into the Liquid. Stir well with a wide, flat paddle that is long enough to reach the bottom of the large bucket.

Mix It on the Job as You Use It—

This *fresh* mixture gives a bright, shiny paint of superior quality, containing exactly the proper proportions of Powder and Liquid. Science has taught us that Aluminum Paint must be freshly mixed to be most effective. This unique Cook package assures *easy, foolproof mixing.*

Fight Sunshine with Cook's Tank Paint —Save 200 Barrels Yearly, Per Tank!

Government field tests on 55,000-barrel crude oil storage tanks show that Aluminum-painted tanks lose by evaporation 200 barrels less oil in a year's time than black tanks.

Black tanks absorb the heat from the sun's rays, causing excessive evaporation. Aluminum-painted tanks *reflect* the sun's rays, and thus remain cool. It's cheaper to paint a tank than to lose 200 barrels by evaporation!

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Factories: Kansas City and Fort Worth

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Gentlemen: Please send me full details of your Special Introductory Offer on Cook's Ready-To-Mix Aluminum Tank Paint, in the new 5-gallon package. Also send me information regarding your Rust Inhibitive Primer and Cook's Steel-Kote. I (have) (have not) seen your booklet "Cook's Paints for the Oil Industry". Please send me a copy.

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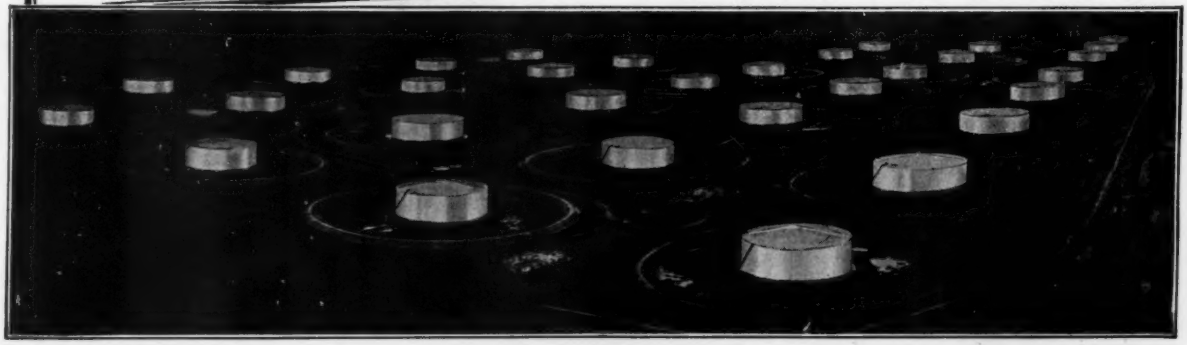


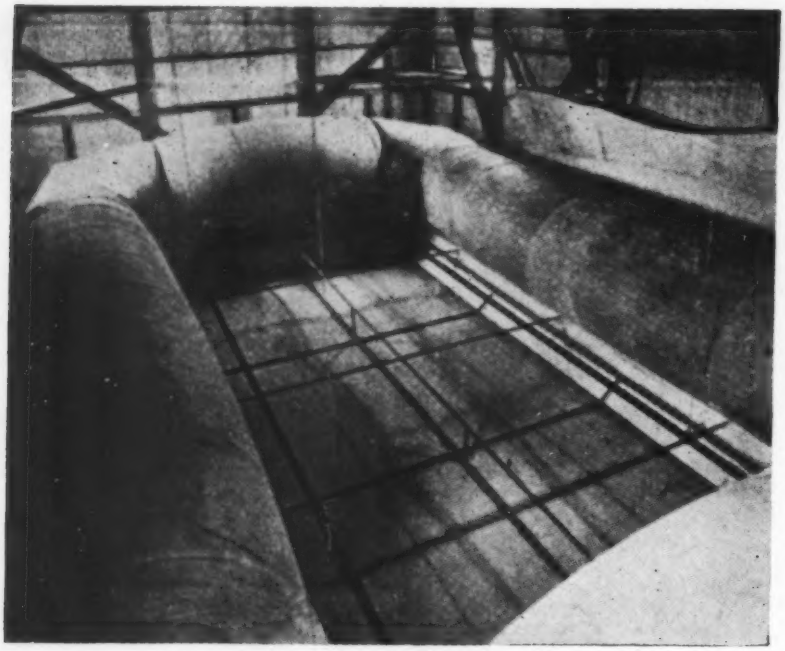


Figure 2—18,000 Cubic Foot Container about Two-thirds Full, Viewed from Above, Showing Balloon Weight and One Counter-weight Belt

imum vapor temperature is assumed to be 105° F. (much hotter than outside air due to radiation from the sun) and the concentration of gasoline in the vapor to be in equilibrium with the surface of the gasoline, the temperature of which is 95° F. The weight of air in the vapor mixture at this time would be:

$$\text{Air} = 1000 \times \frac{750\text{-}295}{750} \times \frac{750}{760} \times \frac{492}{565} \times \frac{29}{359} = 42.1 \text{ lbs.}$$

Under these conditions the weight of air breathed out would be 55.2 — 42.1 =13.1 pounds per 1000 cubic feet of vapor space. Assuming that the average temperature and the partial pressure of gasoline in the expelled air was the mean between the initial and final states in these respects, the volume of air and gasoline breathed out is calculated as follows:

$$\text{Volume of air at 750 mm. pressure} = 13.1 \times \frac{359}{29} \times \frac{550}{492} \times \frac{760}{750} = 184 \text{ cubic feet}$$

$$\text{Volume of gasoline vapor} = 184 \times \frac{240}{750\text{-}240} = 86.6 \text{ cubic feet.}$$

Total volume breathed out=270 cubic feet.

A 120×40 foot storage tank with an 8-foot pitch to the roof filled to the 39-foot level has a vapor space of 41,500 cubic feet for which the above daily breathing loss would be 11,600 cubic feet. If the average composition of the hydrocarbons in the vapor is assumed to be hexane, the volume of liquid hexane lost per breath is as follows:

$$86.6 \times 41.5 \times \frac{492}{550} \times \frac{750}{760} \times 0.24 = 761 \text{ pounds or } 140 \text{ gallons.}$$

By filling these tanks to 39.5 feet the vapor space is reduced to 35,800 cubic feet and the volume breathed would be 9500 cubic feet. Assuming the richness of the vapor to be the same as before, the gasoline loss would be only about 85 per cent of its former value.

Although these calculated volumes breathed are somewhat higher, and the calculated gasoline losses somewhat smaller than those actually measured, they are of the right order of magnitude, and illustrate the relative importance of the different factors.

If the rise in vapor temperature from 75° to 105° F. had been unaccompanied by evaporation of more gasoline, as some investigators have assumed, the breath due to simple expansion would have amounted to only 55 cubic feet per 1000 cubic feet of vapor space. Of this, $\frac{185}{750} \times 55$, or 13.6 cubic feet, would have been gasoline vapor, which is only about 16 per cent of the calculated loss when the displacement of the air by the increased vapor pressure of gasoline is taken into account.

Siphoning—The measured loss figures on many tanks were considerably higher than the foregoing calculations would indicate. In searching for an explanation of this discrepancy it was discovered that on many tanks gasoline vapors continue to pour from the end of a breather pipe which comes down near the ground, even after the temperature in the vapor space of the tank has stopped rising. This effect, at first quite surprising, is due to the siphoning of the heavy hydrocarbon vapors from the higher to the lower level.

The continuance of this action is made possible by sucking air through the minute leaks which generally exist even in fairly good tank roofs (and possibly by an upward flowing current of air through the top section of the breather pipe). Measurements during 1923 showed that this siphoning action might cause the loss from a given tank to be 0.1 per cent per month higher than it would otherwise be. To check this siphon action, various types of liquid seals have been used and all breather bags are loaded so they will not start to fill until the gas pressure at the bottom of the breather pipe ex-

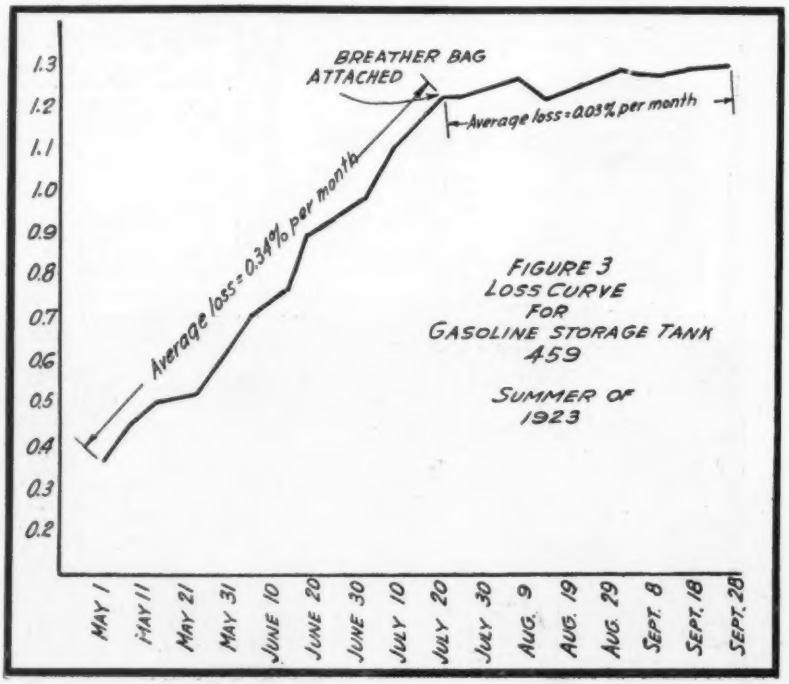
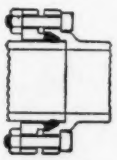


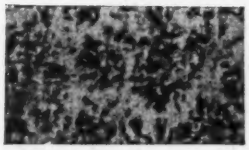
FIGURE 3
LOSS CURVE
FOR
GASOLINE STORAGE TANK
459
SUMMER OF
1923

SIMPLEX CAST IRON CONDENSER PIPING

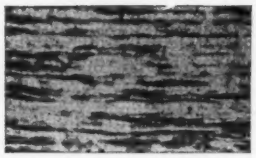


"ONE FLANGE IS LOOSE"

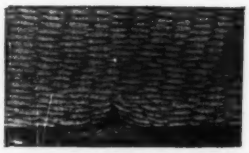
COATS ITSELF



Photomicrograph of cast iron, much enlarged, showing granular structure.



Photomicrograph of wrought iron, much enlarged, showing fibrous structure.



A piece of sheet steel, much enlarged, showing surface and sectional structure with a typical pit.

AUTHENTIC data from over 250 years of service prove that cast iron becomes coated with rust but remains practically unimpaired in weight and strength under conditions that are fatal to other kinds of metal.

Scientists believe this phenomena due to the microscopic structure of cast iron—a structure of the same granular or crystalline form as found in the iron ore from which it is made and which has laid unimpaired in the ground for untold centuries. Cast iron rusts on the surface, but the corrosive agent fails to break the natural mechanical bond between the irregular shaped granules, further oxygen is excluded by the first rust coating, and therefore corrosion stops. Cast iron literally coats itself.

In place of the interlocked grains or crystals of cast iron, wrought iron and steel are of a fibrous and, in thinly rolled steel, of a laminated structure, with distinct leaves overlapping each other. As corrosion takes place, these leaves or fibres scale off, constantly presenting a fresh surface to the corrosive agent.

Simplex pipe is flanged pipe minus the limitations of a joint made with rigid flanges. Thousands of feet of this material has been in use for years by the leading oil refineries of the United States for oil condensers.

Write for Simplex Condenser Catalog Number 55

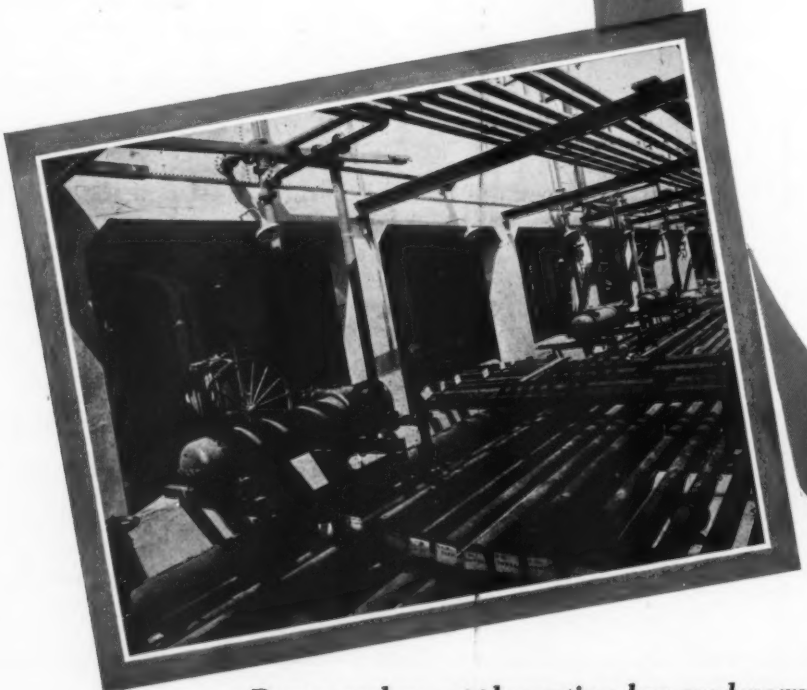
AMERICAN CAST IRON PIPE COMPANY

General Offices and Foundry: Birmingham, Ala.

Branches at
Dallas, Kansas City, San Francisco, Los Angeles, Chicago, New York,

Write Also for information on Our Prepared Joint Cast Iron Pipe for Oil Lines

A battery of Braun dephlegmator circulating oil coolers in a refinery.



Braun coolers supplementing box condensers. Gasoline temperature is reduced to 70 degrees with water at 66 degrees.

Tell them where you saw the ad.

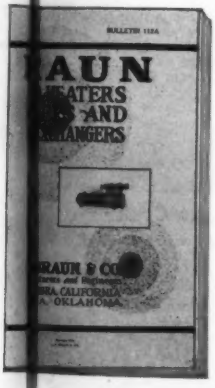
Braun

Meeting the New Requirements . . .

Refinery efficiency is the solution of oil conservation. Its accomplishment demands highly developed equipment.

Braun engineers are ready to meet these new requirements. Through years of painstaking study and experiment they have developed new types of apparatus which are taking an important place in the silent revolution of refinery methods.

It would be to your advantage to let these engineers show you what can be accomplished in efficiency and low-cost operation through the adoption of *Braun* equipment.



Bulletin 112-A covers the subject of Braun fluid heaters, coolers and heat exchangers. A copy will be sent upon request.

C.F.Braun & Co.

Manufacturing Mechanical Engineers
Main Office and Factory — Alhambra, California
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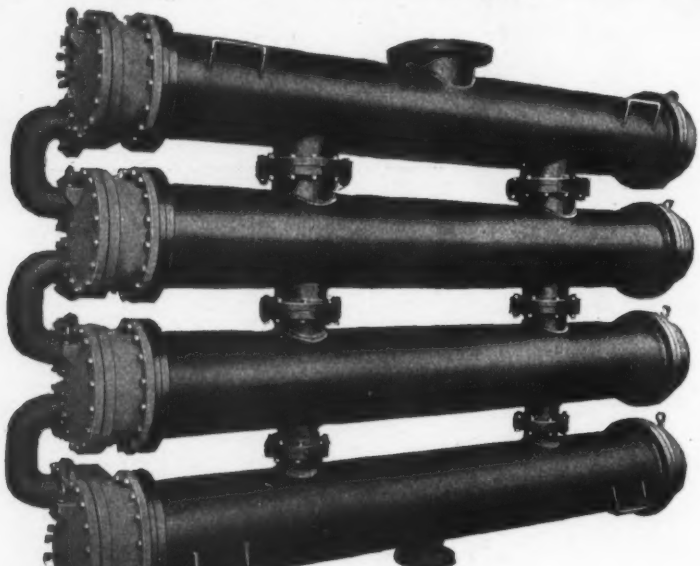
Flexible—

to every service requirement



The G-R Gasoline Condenser

is flexible in purpose, flexible in capacity, and flexible in meeting changing plant conditions.

It can be used either as a natural gas gasoline condenser or as a knockout box or fractionating tower control section.

It can be adapted quickly to small or large capacities as desired.

It can be readily taken apart, transported and reassembled in any desired location to meet changing conditions.

The G-R Gasoline Condenser is so flexible because of its sectional construction, which also makes it compact, easy to erect, easy to inspect and clean, and capable of highly efficient operation.

The complete description and service advantages of this condenser are concisely outlined in Form 210.

Send the Coupon for Complete Information

THE GRISCOM-RUSSELL COMPANY
2135 West Street Building, New York

Philadelphia	Chicago	St. Louis	San Francisco
Boston	Cleveland	Kansas City	Los Angeles
Rochester	Detroit	Charlotte	Seattle
Pittsburgh	Milwaukee	New Orleans	Denver
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For Canada: Riley Engineering and Supply Company, Ltd., Toronto

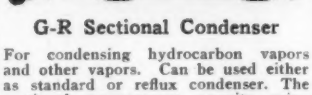
Griscom-Russell

Heat Transfer Apparatus

Note these other G-R units for lower refining costs

G-R Sectional Condenser

For condensing hydrocarbon vapors and other vapors. Can be used either as standard or reflux condenser. The sectional arrangement permits using as a condenser and heat exchanger in one set or to obtain a different cut from each section. Described in Form 198.



Mineral Seal Oil Heat Exchanger

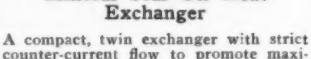
A compact, twin exchanger with strict counter-current flow to promote maximum rate of heat interchange. Described in Form 207.

G-R Vaneflo Gas Cooler

For cooling casing head or natural gas. Can be used as inter-, after-, or precooler in absorption and compression type natural gasoline plants. Has low pressure loss and exceptional efficiency. Described in Form 208.

G-R Jacket Water Cooler

Uses any source of raw water to cool the jacket water from oil and gas engines and compressors. The famous Multiwhirl Cooler—over 2000 in operation in every liquid cooling service. Described in Form 209.



G-R Twin Heat Exchanger

For the efficient interchange of heat between crude oil feed stock and still bottoms, cold water and hot oil, feed stock and hot still vapors, etc. Described in Form 201.

The Griscom-Russell Company.
2135 West Street Bldg., New York.
Please send information on

- ☐ Gasoline Condenser
- ☐ Sectional Condenser
- ☐ Mineral Seal Oil Heat Exchanger
- ☐ Vaneflo Gas Cooler
- ☐ Jacket Water Cooler
- ☐ Twin Heat Exchanger

Name . . . . . .

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. . . . . .

R 9-25.

ceeds the siphon head of about 0.2 foot of water.

Methods of Reducing Breathing Losses

Regardless of the numerical accuracy of the foregoing calculations of breathing losses, they do point out the savings resulting from a small vapor space above the gasoline, and from the reduction to a minimum of temperature changes in vapor space and oil surface. A brief discussion of the available methods for accomplishing these results follows.

Reduction of Vapor Space—To reduce the vapor space in existing tankage the only feasible procedure is to maintain the gasoline at the highest level safety will permit. New tankage should be built with the lowest possible pitch to the roofs, to reduce the vapor space still further. The Wiggins floating roof reduces the vapor space to practically zero and is well worth considering on new construction of small working tanks. It is, however, very expensive to apply to existing tankage. On large storage tanks there is likely to be considerable mechnical difficulty, especially in climates where snow and ice is a factor. The scraping action of the shoe against the tank wall tends to produce dirt, accelerate corrosion, and possibly strike a spark.

The floating foam Sealite also reduces the vapor space to zero, but can only be used on oil in storage. Here it must in general be renewed at a cost of over $3000 per 120-foot tank every time a tank is emptied and often gives trouble by getting mixed with the oil as it is pumped out. In humid climates Sealite tends to absorb water, which sometimes causes the foam to break and sink through the oil.

Reduction of Temperature Variations—Having an irreducible vapor space which of necessity must be filled with air saturated with gasoline and must undergo daily temperature changes, the temperature range can be reduced by any of numerous methods. The methods that have been most successful in practice are (1) insulation with hair felt or cork, (2) shielding with a false roof, (3) painting with a highly reflecting aluminum paint, and (4) spraying with water during the period of naturally rising temperature. Although the first of these methods will save about 65 per cent of the normal loss, none of them effect nearly so complete a saving of gasoline as the breather bag, and the first two cost more than a breather bag installation. The third is cheaper but less efficient at the start and becomes almost ineffective after a few months exposure to the average refinery atmosphere. The fourth requires constant attention to keep the lines and nozzles clean and usually necessitates yearly repainting of the tank.

Conservation of Vapors Breathed—All the devices for reducing breathing mentioned above, with the exception of the floating roof and Sealite, still permit a very considerable loss by evaporation. Hence there is a great opportunity for some method of preventing the loss of any exhaled vapors or recovering their gasoline content whether or not their volume has been reduced by other protective measures.

Absorption Plants.—Gathering systems connected with a central absorption plant are effective but very expensive. They are especially unsuited for gasoline storage tanks, since by manitaining a slight vacuum on the system they suck in air through the small leaks and thus accelerate rather than retard the evaporation. The recovered light ends cannot be conveniently blended again with the gasoline from which they came.

Another suggestion by one of the writers[6] was that individual absorption towers containing the charcoal or fuller's earth be connected to the breather pipes with the expectation that the absorbent would pick up the gasoline from the exhaled vapors during the day and give it back to the inhaled fresh air at night if the latter were warmed somewhat. However, laboratory experiments showed that the reversible capacity of charcoal in this respect was so small that quite large quantities would have to be used to handle the breath from a single tank or else that the inhaled air would have to be heated quite hot. Similar tests are yet to be run on fuller's earth, but on the whole the method does not seem very promising.

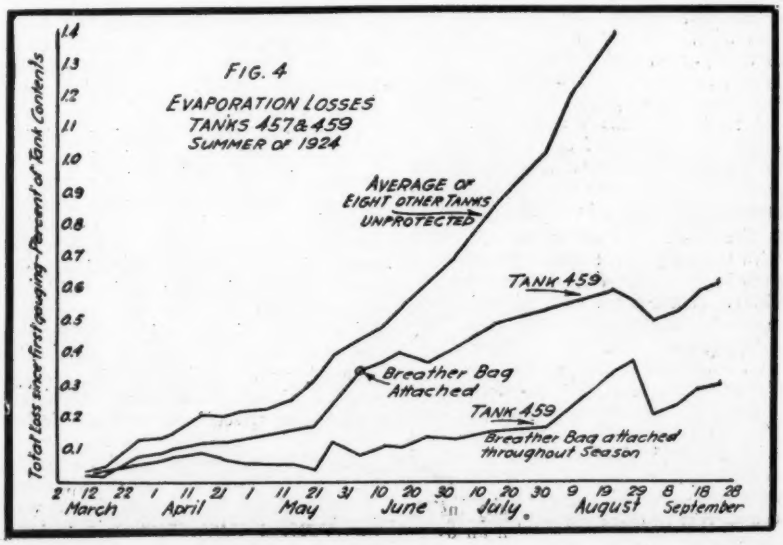
Diffusion Towers.—Dr. G. Cash, of this company, suggested that the comparatively great density of the vapors exhaled from a tank might make it possible to collect them during the day by upward displacement of air from a suitable container. On this basis tests were made on three so-called diffusion towers, which consisted of discarded pressure still shells set on end with a series of horizontal baffles inside to prevent excessive mixing of the tank vapors with the supernatant air. These towers did not show any marked savings, either because of the above mentioned siphoning action which prevented the vapors in the towers from being sucked back at night, or because there was too much mixing.

Gas Holders.—A balanced gas holder connected to a system of tanks would have the advantages of large capacity, long life, and low operating cost, and should be practically as effective as a breather bag for conserving gasoline vapors. However, in order not to exceed the mechanical strength of the ordinary steel plate tank roof the holder would have to be counterbalanced to operate at a pressure not greater than 1 inch of water, tight and operating pressure which would maintain on the tank roof a pressure balanced within +0.1 inch of water would be required to prevent excessive losses by leakage. The construction of a holder to operate smoothly at such a low pressure regardless of weather conditions would be very difficult, if at all feasible, and about three times as expensive per tank as a breather bag installation.

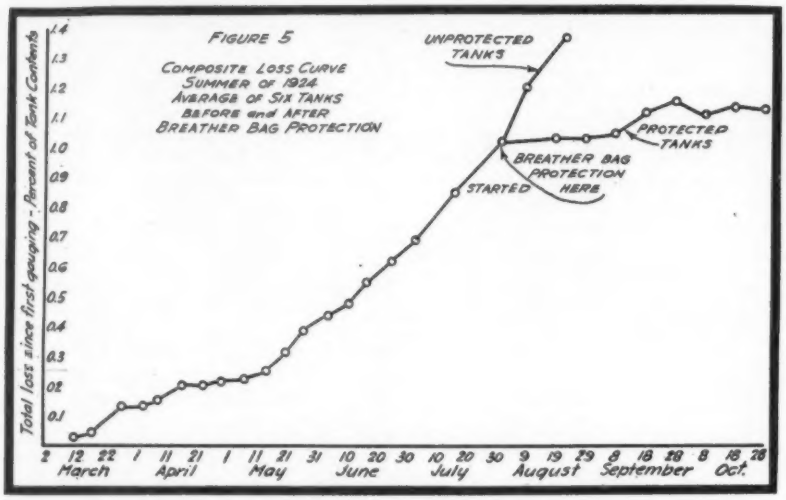
Breather Bags.—Practically all the objections to these other devices were overcome with the development of the balloon type gas containers or breather bags. These are cylindrical bags made of a closely woven 2 or 3 ounce cotton fabric impregnated with a gasoline-proof mixture of glue and glycerol and connected with vapor space of one or more tanks so as to inflate with the vapors breathed out from the tanks during the day time and return the vapor to the tank at night.

Development of Breather Bags

In November, 1922, one of the writers suggested that a flexible gas container for receiving the exhaled vapors from a storage tank could be made of fabric impregnated with some



[6] U. S Patent 1,489,725.



gasoline-proof dope. After much study had been given to the most suitable size, shape and fabric of the container and the best material and methods for impregnation, during the summer of 1923 two 8000 cubic foot breather bags were built entirely at this refinery. In service these proved very effective and reasonably substantial. For further installations, however, it seemed desirable to have the bags constructed by the aeronautics department of the Goodyear Tire and Rubber Company. After thorough discussion of all features of design, an order was placed for five 18,000 cubic foot containers, each designed to handle the breathing of two tanks. These were installed at different points in the summer of 1924. A summary is given below of the development of the more important features of these breather bags.

Mechanical Features.—Fabric. After considerable experimentation a closely woven 3-ounce cotton fabric having a tensile strength of about 40 pounds per inch width was selected as most suitable. This is impregnated at an elevated temperature with a special dope consisting essentially of high-grade glue, glycerol, and water. The excess of dope is scraped from one surface, and the cloth chilled to the gelling point of the mixture and dried. The exact composition of the dope was determined after exhaustive tests on the gasoline impermeability and general stability of fully a hundred mixes.

The dried strips are generally coated with talc to prevent sticking and sewed together into the desired shape by machine. A flat seam with ¾ inch overlap and four rows of stitching has been found satisfactory. The seams are given an additional coat of dope on both sides and this is again dusted with talc.

Design of Breather Bag.—Experience has shown that a cylindrical bag with hemispherical ends is the most satisfactory shape. The 18,000 cubic foot bags now being generally installed are 25 feet in diameter with an over-all length of 45 feet. A bag of this size will easily serve two 120×40 foot gasoline storage tanks during average summer weather around Chicago.

Housing.—Since the fabric of these balloons is by no means waterproof, they must be protected by a weather-proof housing. A wooden frame building with corrugated iron siding and roof has been found satisfactory, but care must be taken to avoid appreciable leaks at the joints and to use high-grade weather-proof ventilators. To hold the ballon in position a 6-inch belly band is attached to its equator, which is clamped securely in a frame fastened to the walls of the house about 11 feet above the floor. When supported in this way the top half of the bag collapses into the bottom half when the bag is empty. This is illustrated by Figure 2. An inlet appendix is provided at one or both ends of the bag, about 18 inches above the floor, and 4 or 6 inch connecting lines sloping slightly downward toward the balloon lead from the tanks or their breather pipes to the inlet appendix. Any condensate in the connecting lines during abnormally cool weather drains into the bag to remain until re-evaporated when weather conditions get back to normal.

Loading.—On account of the shape assumed by the top half of such a balloon during inflation, its operation pressure increases with degree of inflation. Because of the necessity of maintaining balanced pressure under the roofs of tanks that are not absolutely vapor tight, a loading device with an automatically varying counterweight has been perfected which holds the pressure within a balloon at about 0.25 inch of water throughout the greater part of its operating range. Although this has served its purpose satisfactorily it is not considered necessary on tanks with all welded roofs, and the savings in initial cost and complication to be realized by its omission would justify some extra expense in making roofs absolutely tight which are not at first in this condition.

Seals. — Emergencies or unusual weather conditions are sure to be encountered when displacement of vapor from a tank or into a tank will exceed the capacity of the breather bag. To provide for such occasions, a tilting liquid seal has been developed to be placed as a safety valve at the tank end of the 4-inch connecting lines. This seal will open at pressure or vacuum of about 0.25 inch of water and will handle displacements up to 5500 barrels per hour with a total pressure drop through the seal of not over 0.40 inch of water.

Performance of Breather Bags

Gasoline Savings.—During the spring and summer of 1923 and 1924 losses have been measured as completely and accurately as possible on a group of eleven 120×40 foot gasoline storage tanks at Whiting. These measurements consisted of very accurate weekly gauging of outage, accompanied by sampling, to determine the average oil temperature from which the outage at 60° F. was calculated and the loss per week obtained. The results of these measurements are given in Table I and Figures 3, 4, and 5.

Table I—Gasoline Savings Using Breather Bags

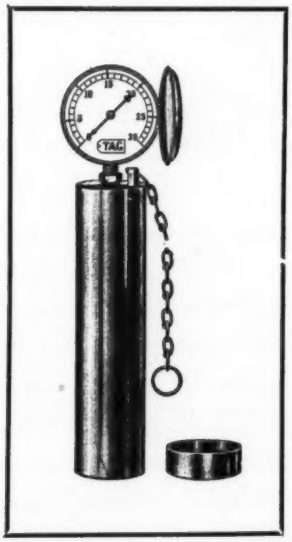
	Loss per cent per month
Previous to 1923	
Tanks with spraying but with no breathers:	
Average for storage season	0.43
Summer of 1923	
All tanks having breathing pipes:	
Unsprayed tanks, March, April and May	0.15
Unsprayed tanks, June, July and August	0.32
Sprayed tanks, June, July and August	0.22
Tank 459 with breather bag, June 20 to September 20	0.03
Summer of 1924	
No spraying:	
Tank 459, with single breather bag, March 1 to September 30	0.04
Eight unprotected tanks, March 1 to August 30	0.25
Tank 457, with single breather bag, June 4 to September 30	0.07
Tank 459, same period	0.06
Average for unprotected tanks, same period	0.35
Tanks 461 to 462 with balloon	0.03
Tanks 454 to 456 with balloon	0.025
Tanks 453 to 455 with balloon	0.05

The curves show that evaporation losses can be consistently reduced from 0.25 per cent average for unprotected tanks to 0.04 per cent per month throughout the storage season by the use of breather bags.

The early losses from three tanks connected to double balloons were slightly higher than the average of other tanks with similar protection. This was undoubtedly due to leakage through partially opened drain valves on the steam fire lines, which were not discovered until late in the season, and to leakage around the liquid seals before they were perfected. This latter cause was also responsible for a slight increase in loss from one tank with a single breather bag. Hence the composite loss curves for all tanks with breather bag protection, as shown in

OIL TESTING INSTRUMENTS

WE HAVE in Wichita Falls the most complete and largest assortment of oil testing instruments and general laboratory equipment and supplies in the southwest, catering particularly to the oil and gas trade.



"TAG" OIL and GAS TESTING INSTRUMENTS

PYREX GLASS

MERIAM MANOMETERS

"TAG" RECORDING INSTRUMENTS

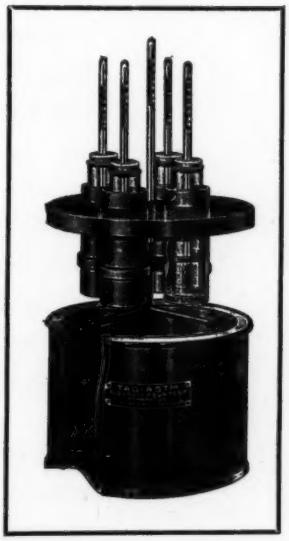
"EAGLE THISTLE" HEAVY CHEMICALS

BAKER'S CP-ANALYZED CHEMICALS

Merco Nordstrom Lubricated Plug Valves

"TAG" CONTROLLERS for TEMPERATURE and PRESSURE

HAYS GAS ANALYZERS, ETC., ETC.



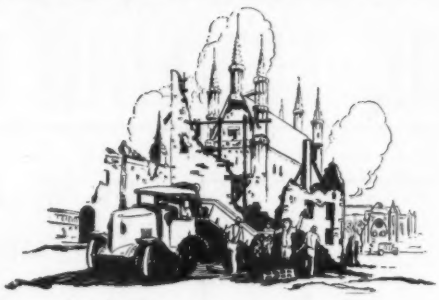
GREENE BROTHERS

SCIENTIFIC LABORATORY SUPPLIES
COMMERCIAL AND REAGENT CHEMICALS
REFINERY AND POWER PLANT SPECIALTIES

WICHITA FALLS, TEXAS

SWITZERLAND – ITALY – SPAIN – HOLLAND – DENMARK – SWEDEN – EGYPT – RUSSIA –

ENGLAND



BELGIUM

Natural Gasoline . . .

America exports annually more than one billion gallons of gasoline. This is distributed between those great nations of the world that have placed the gasoline engine as a power factor in the vanguard of the march of civilization. To each gallon is added a percentage of NATURAL GASOLINE which enables the refiners to maintain the quality required of gasoline refined straight from crude oil without increasing the cost.

In London this "little leaven that leaveneth the whole lot" is appreciated by the fastidious Englishman, who owns a car as he owns a yacht and who insists upon gasoline of high gravity.

While, just across the channel, in that great week-end rendezvous of Europe, you will find his brother Parisian driving cars of such mechanical perfection as to justly deserve a motor fuel of the very finest.

NATURAL GASOLINE
DEPENDABLE SERVICE

Then in Belgium, where a courageous people are struggling to revive their war-torn country, that extra pep and

N A T U R A L I Z I N G T H E

Tell them where you saw the ad.

INDIA – AUSTRALIA – CHINA – CANADA – MEXICO – SOUTH AMERICA

JAPAN

FRANCE

power value of NATURAL GASOLINE is put to more practical use in fueling powerful motor trucks that have to struggle up out of deep holes with stalling loads, where a single ounce of inferior motor fuel means a set back and a new start.

Nor is the distribution of NATURAL GASOLINE confined to this part of the world. The stream flows east into that most modern and progressive little country—Japan. For the wily Japs have not overlooked so efficient an aid and ally.

So, from the seaports of America flows this mighty stream of NATURAL GASOLINE demanded by one and all as an indispensable acquisition to the gasoline refined straight from crude oil.

CHESTNUT & SMITH
CORPORATION
TULSA, OKLA.

WORLD'S MOTOR FUEL

Tell them where you saw the ad.

Photograph and article from National Petroleum News, June 17th, 1925, describing a recent refinery fire.

—yet one tank was saved

—the only one Oceco equipped in the exposed area

...tank with insulated roof and equipped with an Oceco vent valve and flame arrestor to keep the fire from flashing back into the tank. This escaped with no damage but burned off paint.

...became a blow torch as the gases generated inside the still by the fierce heat, rushed out to be ignited by the blaze.

A dozen or so tanks holding various kinds of oils, which stood in the path of the blazing oil, ignited and collapsed and their contents was added to the flood of fire. The burning gasoline

This tank, full of gasoline. stood within 10 feet of one of the agitators that burned. It was heated to a tremendous temperature, of course, by the blaze. As the vapors expanded within, the safety vent valve opened and the escaping vapor blazed to the sky but the tank did not collapse or even buckle.

A contract for ... plant wa...

A LESSON from the fire, as expressed by the General Manager: "Install gas-tight tanks with proper vents and flame arrestors."

Again, Oceco Equipment *proved* its merit under the most severe conditions.

THE OIL CONSERVATION ENGINEERING CO.

Headquarters for Tank Equipment

877 Addison Road — Cleveland, Ohio

25 Broadway . . . . . New York
325 Iowa Building . . . . . Tulsa, Okla.
O-S Building . . . . . Casper, Wyo.
318 East 12th Street . . Los Angeles, Cal.
440 Howard Street . . San Francisco, Cal.
W. K. Henderson Co. . . Shreveport, La.
Beaumont Export & Import Co., Beaumont, Texas, and Tampico, Mexico.

See the complete line of Oceco Equipment at the Tulsa Exposition, Texas Building.

OIL TANK OCECO EQUIPMENT

SAVES EVAPORATION AND PREVENTS FIRE

Tell them where you saw the ad.

Figures 4 and 5, are somewhat higher than can reasonably be expected when the above-mentioned defects are corrected.

Capacity.—Observations made during August and September, 1924, on a 120×40 foot tank connected to a single breather bag indicate that for a maximum vapor temperature rise to 110° F. a breather bag capacity of 7000 cubic feet is ample. To provide for occasional higher maximum temperatures and to leave some margin of safety for periods of steadily rising temperature when the bag will not completely deflate at night, it is planned to allow a capacity of 9000 cubic feet for tanks of this type.

Durability.—Samples of the lighter fabric of the first five balloons have been left in the various breather bag houses, where they would be subjected to the same atmospheric conditions and acid fumes as the bags themselves, and occasionally tested for tensile strength, with the following results:

	Lbs. per inch
Cloth before impregnating	18
Cloth freshly impregnated	36
Impregnated cloth after 17 months in balloon house	36

There are now no visible signs of deterioration, such as cracking, peeling, hardening, or molding of the fabric in the original bag, which has been in place for 23 months. Some small rips have occurred in each of the small bags as a result of excessive local strains caused by the rather crude methods of supporting the bag in these instances, but all probability of such trouble has been eliminated in the later 18,000 cubic foot installation. However, it should be pointed out that such leaks can be very simply repaired by sewing on a patch of balloon fabric and painting thoroughly with hot glue. Present indications are that a life of 4 years is practically assured, while a life of 5 or 6 years may reasonably be expected. The house, of course, will last much longer than this.

Cost and Savings

The cost of the 18,000 cubic foot balloons on which the Goodyear Company has standardized is about $1500. The cost of the housing, piping and all other necessary equipment varies from $3000 to $3500, depending upon conditions and material costs. On the average, however, the complete installations cost less than $4800, or $2400 per 67,000-barrel tank.

In special cases it is possible that further savings can be effected. Many storage tanks are now built with all roof seams welded, so that with extra

Figure 6.

care in tightening hatchways, thief holes, and cable guides there should be no appreciable loss of vapors, even if the pressure under the roof should vary a few tenths of an inch above or below atmospheric. Under such circumstances a breather bag could be used without any loading or counterweight system. This would reduce the initial cost by about $400.

In other localities, where atmospheric corrosion is not so severe as at Whiting, much lighter metal can be used for covering the balloon house. The use of 27-gage painted black iron saved about $500 over the above figures. Where the roof pitch is lower or the tank roof is insulated it is possible to attach more tanks to a single balloon, thus reducing the cost per tank.

The losses from 65,000-barrel storage tanks of gasoline at Whiting averaged about 0.25 per cent per month from March to October, 1924. Breather bags reduced this loss 0.04 per cent, or a saving of 0.21 per cent or 6900 gallons, which at 10 cents per gallon is equivalent to $690 per tank per month. An 18,000 cubic foot breather bag protecting two 65,000-barrel tanks thus saved $1380 per month under these conditions, paying for itself in 4 months. The savings will, of course, vary somewhat with the climate and the volatility of the gasoline.

As the result of this comparison, about 65 balloons and houses have been installed for the protection of practically all the gasoline storage tanks of the Standard Oil Company (Indiana) and a number of other installations are being planned.[7]

Other Possible Applications

Crude Oil Storage.—Wiggins[8] points out that 35° Kansas crude oil evaporates more than half as fast as a 62° gasoline cut from this same crude. A similar comparison was made in this laboratory between Red Crown gasolin and Mid-Continent. Cat Creek and Sinclair crude oils, both by bubbling measured quantities of air through the oil, and by exposing dishes of the different oil to the still air, all at room temperatures. The losses in these tests ran somewhat lower than found by Wiggins, showing a rate for the crude oil averaging about 30 per cent of that for gasoline. The crudes tested had, however, already lost some light ends in storage and transit.

These figures indicate that there is an opportunity for a considerable saving in the use of breather bags on gastight crude oil storage tanks, though it is not so promising as on gasoline except possibly on very light crudes or in hot climates.

Other Light Oil Storage.—Light gasolines, special naphthas, etc., because of their volatility and value offer a great opportunity for savings by the use of breather bags. However, such stocks are always stored in much smaller quantities, which makes protection more expensive per gallon saved.

Working Tanks.—In general, the filling of a receiving pan or working tank displaces a much larger volume of vapor than could be handled by any breather bag which it now seems practicable to build. However, working tanks are generally operated in pairs, one being filled as the other is emptied. The same is true at many pipe line stations. If the filling and emptying rates were exactly the same all vapor loss except that due to temperature changes could be prevented by interconnecting the vapor spaces with a single outlet so that the vapor displacement from one becomes the intake of the other. It is rare that such a perfect balance prevails, the system as a whole generally having a small periodic displacement and intake. This net vapor volume change from a pair of tanks can frequently be taken care of by attaching a breather bag to the above-mentioned single outlet. The possible savings to be effected in this way appear to be very large, and several such installations have already been made, with considerably greater savings per balloon than on gasoline storage.

Plant Activities

Artesia, New Mexico.—Two refining plants have been put in operation here in the past month. The Gilliland Oil Company has its Albuquerque plant operating on Artesia crude, delivered by tank cars. This is a plant of 1,500 barrels capacity.

The Ohio Oil Company has begun operating a 500-barrel skimming plant at Dayton. Oil from the Artesia field is delivered by tank cars.

The Artesia district now has four refining plants, as the Gilliland Company has one at Roswell, while the New Mexico Pipe Line Company has one here.

Production from the Artesia field, not run in local plants, is being shipped to the Rio Grande Oil Company plant at El Paso.

Fred C. Tilson, representative of the Mathieson Alkali Works, Inc., whose headquarters office is in the Commercial National Bank Building, Charlotte, North Carolina, is on a trip through the Southwest, visiting refiners.

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[7]The breather bag system of tank protection, the fabric, the liquid seals and the special methods of protecting working tanks are all covered by U. S. patents or pending applications.

[8]Bur. Mines, Bull. 200, p 95.

Which—Men or Miles Per Gallon

By Captain A. A. Nicholson
The Texas Company, Port Arthur, Texas

HAVE you ever stood at the yawning gates of some great industrial plant in the morning and watched its workers enter? Some of them are joking and jolly with an attitude of being carefree, as though they were leaving no responsibilities behind them nor were these any ahead of them. Some of them are sour and sullen and act as though they might have left home under unpleasant conditions, or that they had a dread of their job or the day ahead of them. Some of them are gloomy and grave and walk through the gate as though under heavy burdens, and yet insistent that they carry their load in the plant and on to their job rather than to leave it on the outside. Some of their faces seem to twitch and twist as though they were in physical pain, and their haggard looks seem to indicate that they have spent a sleepless night, and yet they force themselves on through the gate in order to make the day. Some of them are blank and expressionless—more like automatons—as though they had no interest whatsoever in what had happened yesterday or what might happen today or tomorrow. Some of them appear limp or look at you with a peculiar squint of their eyes that tells a story of pain and suffering and time lost, but nevertheless, there is an attitude of thankfulness about them as they hobble through the gate; and now and then there is one who walks with a spring in his step, a glow of health about him, and a wholesome look of determination in his eyes, and he swings through the gate as though there is much for him to do and he must be about it.

What do as many facial expressions as there are workers tell you as they pass through the gate? Does there seem to be any connection between that expression and your plant; the quality of your product or the efficiency of its operation? Let me answer that question by asking you what your thought is when, in your plant, you find that your equipment is rusty, battered, leaking or without lubrication? Wherein lies the difference? Are they not both machines—your machines so long as they are in your plant? Perhaps you have a pump that cost two hundred dollars that you house and paint and lubricate—why? To save it. If it breaks down you have it repaired and put back into service—why? Because it cost you two hundred dollars. And who repairs, some other machine?

Yes—a human machine—a man. Then how about this man? He has cost you at least two thousand dollars if he has been with you two years. Do you protect him from the weather of thoughtlessness; do you keep him painted with a coat of ambition; do you protect him from the rust of routine and sameness, and if he breaks down can you repair him and put him back into service as good as new?

Christianizing industry with safety is a much bigger job than Christianizing China with the Bible—doctrine and theory may do well for the higher caste, but you are bound to get better results with a war club out in the rank and file. Although in our plants we are preaching, we are nevertheless doing most of all individual work—we've got to, for we are determined not to give up business, and we fully realize that to keep the business means that we've got to keep the men—on the job and not on the roll.

That watchman who stands at your gate with an empty sleeve; that blind fellow who sells pencils on the corner; that chap who lies at the hospital with a foot gone, and the unfortunate victim they buried last week—all are pieces of industrial equipment. Whether or not they were on your roll, they are nevertheless pieces of industrial equipment that required thirty or forty years to build plus the cash investment you had in them if they did happen to be your men. Well, what are we going to do about it? Are we going to fold our hands and say, "It's too bad," "I'm sorry," and "Bill was a good worker, too," or are we going to jump into the game before it goes any farther and get Bill or John in the plant, as well as every Tom, Dick and Harry who comes into the plant as a new man, by the slack of the breeches and hold tight until we have made out of them junior safety engineers; until we have pointed out to them the stumbling hazards of the industrial road; until we have made them realize that capital is human the same as labor, and until we have gotten them into the industrial lathe and begin to shape them up, not only into the type of worker needed today but the type we are going to need tomorrow.

Safety Education Essential For New Employes

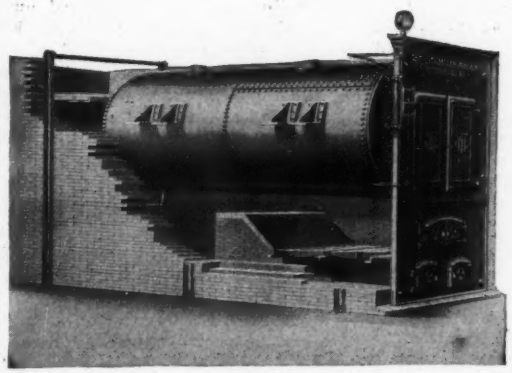
The new man is the fertile field. Upon him depends tomorrow's turnover, tomorrow's accidents and tomorrow's production. Today we only invest in him, and at our plant we enlist all of the wisdom and care we have in the selection. We protect him through educational methods; we lubricate him through liberal and practical policies, and then through the foreman we hold him by the slack of the breeches until we are quite sure that his work and his industrial conduct are of a quality to parallel the products of our plant. We try to make him get the point that he is one of us, and that if collectively, through individual effort, we can make gallons per man that the miles are bound to be there.

In order to get results from men, they must be trained, and unlike your machines they react according to conditions. When you hired a worker, there was a mutual selling agreement. He sold his services to you and you sold the job to him, but if your investment was made from a business standpoint, and if you expect to receive a reasonable return from your investment you still have much more selling to do—you must sell him the company he is working for. In other words, you must develop him to the point where the man creates the job rather than to have the job call for the man, and you must keep him safe.

In our plant as the new worker grows and develops, he is put out in broader pastures, so to speak, through the avenue of transfer and herein lies a point that has been carelessly overlooked by some companies. It is so common to thing that because the new man has been talked to concerning safety, that because he has been shown a number of ghastly pictures and because he has been told that it's up to him to be safe, he is thusly insured against all accidents and for all time to come.

Just suppose that you employ a man as a pipefitter helper, and a man who is off the farm for the first time. When you hire him you discuss the safety situation with him, and perhaps you go into detail with him regarding the hazards of the pipe gang and show him how to correctly handle a wrench, or warn him against breaking into a line carrying pressure, or any of the other common hazards of that particular type of work. Then, six months later you transfer him to gauging. He's been off the farm six months, remember, working in a big industrial plant, and living in a busy community amongst new surroundings. Can you expect him to be familiar with the dangers of hydro-

Titusville Horizontal Return Tubular Boilers



A type that gives long and satisfactory service.

Built with liberal allowances for safety beyond actual requirements of A. S. M. E. Code.

Stock designs and sizes—or built to specifications. Steel Casings and suspension frames furnished when required.

Write for descriptive bulletin

The TITUSVILLE IRON WORKS Co.
TITUSVILLE ~ PENNA.

TITUSVILLE EQUIPMENT

Oil Country Boilers
Steam Drilling Engines
Tico Gas Engines
Flapper Valve Pumps
Pumping Powers
Twin Drilling Engines
Rotary Machines Rotary Drawworks
Swivels Slush Pumps
Crown Blocks
Traveling Blocks
Rotary Drilling Specialties

TITUSVILLE OIL COUNTRY MACHINERY
RUGGED ~ ENDURING

AFFILIATED COMPANIES FOR DISTRIBUTION

For Mid-Continent, Eastern, Western and Coastal Fields:
The Continental Supply Co.
Titusville Machinery carried in stock at all Field Stores

For Export:
The Continental Well Supply Company,
No. 2 Rector Street
N. Y. City

Tell them where you saw the ad

gen sulphide gas? What does a spark around light oil mean to him? What does he care which way the wind blows? Does he appreciate the value of handrails, or why should he worry about oil on the walkway as long as he is lucky and doesn't slip?

We believe that it pays to continue to train this worker along the lines of safe conduct. We don't feel that we can charge him up with gross negligence for an accident until we have furnished him with pertinent information that he is entitled to know, and we think in terms of tomorrow, for if he can grow from pipefitter's helper to gauger, he can most surely grow from gauger to pumper or stillman, and if he's going to grow he must be kept safe. Of course, he has his part of the game to play, but you can't expect him to play intelligently unless he knows something of the game he is in. And so, while we are talking to the public in terms of miles per gallon, we are training the worker whom we transfer to carry on his job with the thought of minimizing men per gallon.

Safeguarding Workers Is Important

There is none who can not use and profitably use safety, but on account of the fact that there has been no monetary cost attached to it for the individual, it has been considered as cheap, and its cheapness has blinded them to its intrinsic value. Education will open their eyes to its real worth. I venture to say that a close analysis of the accident statistics will discose the fact that ninety per cent of such accidents clearly demonstrate the item of irresponsibility of the individuals concerned, and this, in spite of the fact that such particular plant referred to was as fool proof from a safety standpoint as was practically or consistently possible. It is my opinion that one of the industrial fallacies has been to endeavor to safeguard the equipment and forget that the big issue lies in safeguarding the worker.

The safeguard for the human machine is education—sound, practical, logical, education that must start when the new man is enlisted and must remain with him so long as he is a part of industry. A number of past instances in which industry has tried to sell safety to its workers could be made comparable to possible results had Mr. Wrigley simply put his Spearmint gum in a few shops and then sat down to await results. He didn't do that by any means—he put on an educational campaign of advertising and made the public believe that he had just exactly what they were waiting for. You have got to handle safety in much the same manner—advertise it in an educational manner and put over a definite program, the objective of which is the prevention of accidents. Show your workers that it's what they need—that it's a delightful habit—it may not clean the teeth but it will surely save them. Don't confine it to one corner of the plant but spread the stuff where none can miss it—don't ever have a customer catch you out of stock—and if the sales run low put more pep into your advertising. When we view it from a business standpoint, safety is just as much a part of the industrial game as is the checkup we give the time cards or any of the other items that enter into the dollars and cents of the business. It's good for the worker and it's good for the company and means money for both.

Simply joining the National Safety Council, engaging a technical engineer, the installation of a bulletin service, or any other of a dozen different things won't make your plant safe or keep your workers from getting hurt, unless you spice it with advertising and flavor it with practical education.

"Safety First" More Than Mere Slogan

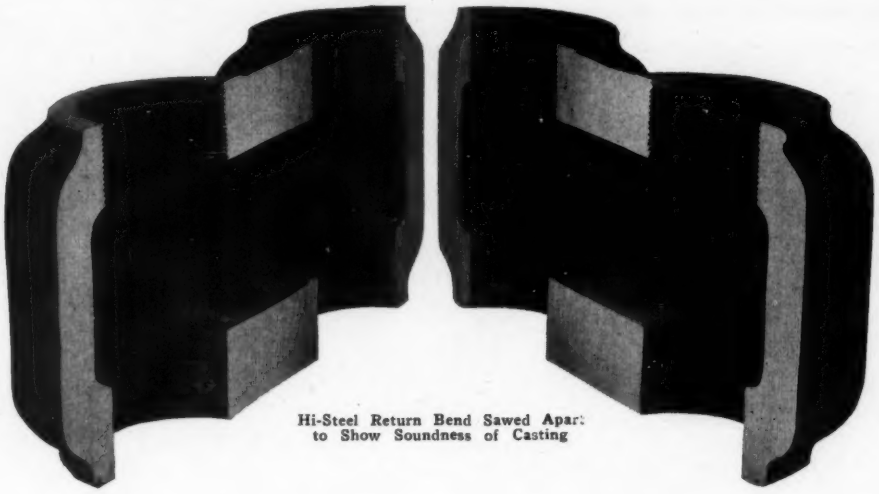
Gentlemen, "Safety First" is indeed more than a couple of words or a slogan—it's something more than a bulletin or a warning—it means more than compensation, money or lost time. It is a living vital part of every human life—it is the elixir of life of the home, the shop and the street—it is the natural binder of human relationship—it is an indefinable thing that helps transform an animal into a man—and in the petroleum industry it is the factor that makes human mileage out of men per gallon.

The question may be raised as to how we are going to carry on this program of education, how much will it cost and what will we get out of it. Let me say right here, that the law of averages never fails, and we are bound to get out of our safety program just exactly what we put into it, and that business would never have universally adopted the safety program if its cost had exceeded the cost of compensation, to say nothing of the cost in human life and limb. Even though we take up safety work—if it's in a half-hearted and rather disinterested way we are apt to get out of it a lot of dead and crippled workers, a multitude of broken homes and families, a host of fearful and disgruntled workers, and the everlasting condemnation of an unforgiving public. But, if into safety, we put pep and enthusiasm, spirit, faith and belief; if we are interested in increasing plant efficiency; if the killing and maiming of our own kind is repulsive to us, and if we realize that the human machine is our most precious asset, and that the great industrial structure which we are erecting must have a foundation proportionate to the super work, then we are going to get out of it, dollars and cents, efficiency and economy, and the unpriced satisfaction of having rendered real service to others and to have helped in the building of real homes and real happiness.

In order to show you how we are carrying on our educational safety work, I am going to assume that you are the new man and that you and I are going through the works to see what is being done along the lines of safe practices. Mind you, I have said safe practices, for although we do pay much attention to safe appliances, we nevertheless consider the question of safe practices the one of prime importance. When the new man is signed up he is given a talk in his own language concerning industrial safety. Then he is segregated according to vocation and is given in more detail the particular hazards of the job to which he is to be assigned. In connection with the employment department, there is a safety museum in which is vividly brought out the common dangers of an oil refinery, the items that contribute to accidents, and things that portray tho results of carelessness. Then, the new employee is actually taken out onto the job where he is to serve and the proposition of job safety pointed out to him from a practical standpoint. Further, he is taken through the plant in general, and during the trip existing plant and departmental regulations are explained to him: he is shown his lockers and shower room; the cafeterias and the first aid rooms are pointed out to him, and any other item which may be either of interest or which may have an influence in really selling him the job and the company. Of course, this does not of itself make a safe worker, but such a procedure offers a much greater opportunity to develop a safe worker than as though he had simply been signed up, and on the following morning shoved out on the job and told to go to work. It takes a long time to equip the human machine with the safeguard of carefulness, but you can cripple him for life in the twinkling of an eye, and many cripples have been so made through ignorance.

Seventy-Six Bulletin Boards

The Chinese are not far wrong when they say that one picture is worth a million words. This is the secret of the average safety bulletin service. We believe in advertising safety to our workers as much as we do in advertising our products to the public. How are they to know much about it if you don't tell them something about it? In our Port Arthur plant, we make use of seventy-six neat, attractive and substantial bulletin boards which are changed twice weekly. We don't make the workers pass the boards, but we put the boards where the workers have to pass them, and whenever we find a new trail developed through the yard, up goes a new bulletin board. In addition to these service boards, we maintain within the plant our own billboard service, and upon which appear pertinent messages, the chief topic of which is safety. Do the men pay attention to these? Of course, they do, and hundreds of times we have planted our bulletin service and proven that it was



Hi-Steel Return Bend Sawed Apart to Show Soundness of Casting

Why Hi-Steel Fittings and Pressure Castings Are Good

The patterns for Hi-Steel fittings and pressure castings are made especially for steel molding, under the supervision of practical steel foundrymen; trial castings are sawed apart to examine the effect of heading and gating the pattern.

The phosphorus and sulphur content of Ohio electric steel is 30% below the usual specifications, positive assurance against fatiguing in service. This is due to our selected steel scrap, and the use of heads and gates from our basic open-hearth furnace at Lima. The elimination of other impurities that weaken the casting and the close chemical control of our electric furnace metal insure clean, solid castings without shrinkage, cavities or other defects.

All molds and cores are oven-dried. All Hi-Steel fittings and pressure castings are scientifically annealed, machined and tested to several times their working pressure. They are made in standard types and sizes or to special drawings for any working conditions.

The making of castings, machining and testing are under the same supervision; no chance to make the same mistake twice.

Write for prices, sending blue prints for special fittings.

"OHIO" PRODUCTS

- Electric Steel Castings
- Hi-Steel Fittings
- Open Hearth Steel Castings
- Fahrite Heat-resisting Alloy Castings
- Tank Car Bolsters, Side Frames and Repair Castings.

The Ohio Steel Foundry Company

SPRINGFIELD, OHIO.

SALES OFFICES:
Houston—Harrisburg Pipe & Pipe Bending Co., of Texas
Chicago—Peoples Gas Building
New York—50 Church Street
Philadelphia—22 South 15th Street
Los Angeles—4920 Loma Vista Av.

PLANTS IN
Springfield
Lima

THE HARRISBURG PIPE & PIPE BENDING CO. OF TEXAS, INC.,
Houston, Texas.
Distributors for Texas.

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'UNITED' GAS-TIGHT TANKS

—An Assurance of Long Service!

There is no secret as to the lasting quality of "United" Gas-Tight Tanks. They last longer because they are

—designed right
—fabricated right
—erected right

And, they are heavy plate, tight riveted, tight caulked—and guaranteed gas-tight.

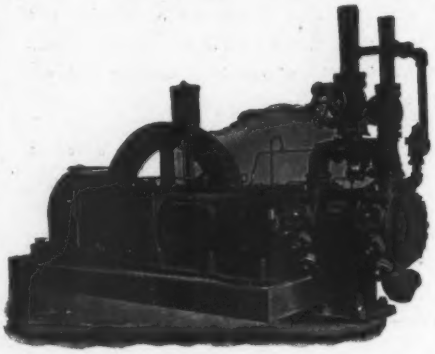
Let us quote you on your requirements. Estimates promptly furnished without obligation.

UNITED IRON WORKS, Inc.

TULSA LOS ANGELES KANSAS CITY DALLAS

Vilter **Ammonia Compressors Fittings and Pipe Coils**

Render Years of Reliable Service



Compressors built in several types and a great variety of sizes. Illustration is of a high speed type compressor.

Complete Data on Request

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getting much closer attention than we had estimated.

Nearly every industrial plant maintains a house organ and herein lies a broad avenue for promoting educational safety. Every worker reads the house organ. We promote safety through our house organ, "The Look Box," by general safety articles; by articles covering individuals in our own service, by bulletins and by cartoons and comic strips. The value of the house organ goes further than the worker—it goes to the family at home, for invariably these periodicals go home with the worker, and so instead of helping one you are helping a possible four or five through this channel.

The safety activities at the Port Arthur works heads up in a general plant committee, the membership of which consists of area supervisors, plant physicians and department heads. This committee in turn functions through a number of sub-committees which cover the shipping department, the mechanical department, the construction department, the pressure stills department, the laboratories and trucks and trains. The personnel of these various sub-committees is composed of head foremen and foremen who are specialists in their respective lines, which means that the sum total of these committees represents some seventy prominent and enthusiastic foremen who are solidly lined up against "old man carelessness." One of the features of the activities of these committees is a semi-annual safety drive. These drives extend over a period of one week and are educational in nature rather than spectacular. In our drives we feature special talks, parties for children, dinners for foremen, motion pictures, special bulletins and other things which get the workers and their families to stop, look, nad listen.

A call comes from the manufacturing department for a gauger or a fireman or any other kind of an operator. We have the man vocationally suited, but have we a safe man? The human machine through transfer will have to be modified, in that he is warned of the possible hazards existing in the new line of work he is about to take up. We find that it pays to give the transferred worker some close individual attention, when starting out on his new duties. At the time he is transferred, the new job is gone over thoroughly with him; then he is taken out on the job and the things which have been told him are gone over in a practical way, and finally he is turned over to one of the older employees in that department, who, together with the foreman, continues to train him so long as he is on that particular job or in that particular department.

Accident Report Carefully Checked

The accident report of every department is carefully checked each day, and any items which are irregular or

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The "Southwestern" Portable gasoline Absorption Plant is a new development in absorption practice, embracing many advantages which are immediately apparent to experienced operators. . . . . This plant will handle gas as efficiently as any type of stationary plant. It can be installed ready for operation in a very short time. Its capacity is quickly and easily increased by installing additional units. The capacity of multiple unit plants can be reduced quickly by removing one or more units, leaving sufficient capacity to treat a decrease in gas volume without tying up surplus equipment. It can be disassembled, moved and re-erected quickly and economically. The salvage value is practically one hundred per cent. . . . . The cost of this plant is less per gallon than that of larger stationary plants when high salvage value and other features are considered. Write for complete descriptive bulletin.

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Plate & Angle Iron Columns
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To Prevent Heat Waste from Still Settings

The insulation of still settings necessitates no departure from conventional design. In new construction Sil-O-Cel C-22 and Sil-O-Cel Standard Insulating Brick are incorporated in the structure as a backing to the fire brick. Existing equipment can often be insulated while in service with a "veneer" course of Sil-O-Cel brick on the outside.

The advantages of insulated construction are fuel economy, uniform heat distribution and less time loss in bringing the equipment up to temperature. Fuel savings alone, even where natural gas or other cheap fuel is burned, often repay the entire cost of the insulation within the first year of service.

Sil-O-Cel is also used for insulating still tops and ends, for covering tanks and dephlegmating towers, for insulating boilers and flues. Five forms—brick, block, powder, plastic cement and "C-3" (a coarse-burned aggregate for mixing with cement to make insulating concrete)—provide an efficient, easy-to-use form of insulation for every kind of heated equipment.

May we send you our complete handbook on the insulation of oil refinery equipment?

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any reports which vividly bring out gross negligence on either the part of the worker or the company are immediately taken up with the foreman. This is a method of schooling the foreman, who in turn schools the worker, and so a double result is made possible. Further, within the complete safety organization, there is a committee set up that makes a detailed investigation into every lost time accident, and the findings of this committee are transmitted to the management together with such recommendations as the committee may see fit to make, either for the correction of some existing condition or the awarding of discipline to an employee who might have flagrantly disregarded some pertinent regulation.

The worker who knowingly breaks some plant or safety rule or who has no regard for his co-worker needs to be brought to his senses through discipline, which should be proportionately severe to the offense, and yet just from a practical standpoint. If any such employee repeats the offense, or if he will not fall in line with safety after reasonable training, then the easiest, the best and the most logical thing to do is to separate him from your service.

Industries which have adopted safety generally follow one or two methods. There is the practice method and the preaching method. Issue your men a highbrow technical book on "How to Be Safe," and see how much the accident situation is affected. But, if the management will go out on the job and will constantly stay out on the job and get Bill Smith when he leaves some boards with nails sticking up on them and help him bend them down, and while helping him tell him something of the possible consequences of the upturned nails, and possibly point out some known case. And when Tom Jones goes up to do some rigging without his safety belt, the management will say, "Come on down, Tom, and get a safety belt, and the next time you do that stunt we're going to get a new man." Tom will come down and will get his belt and he's quite apt to wear it thereafter. And when Harry Brown insists on crossing over a passing train—poor, rushed Harry, who has but sixteen hours ahead of him in which he has nothing to do but eat and sleep—if the management will put their hands on his shoulder and say, "Let's wait, Harry, that's against the rules, and besides, it may cost you an arm," Harry will be found to wait with you until the train has passed, or any other of the hundreds of instances that happen daily in an industrial plant, the accident record will be noted to be coming down, and always as the accidents decrease the individual happiness and the general plant efficiency increase. We use both methods—that is, we do a little preaching and a lot of practicing, and our results most surely

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For this purpose, we manufacture the DUPLEX VACUUM REGULATOR, which acts as a safeguard when used on the vapor lines connected to storage tanks, for the recovery of the gases, the purpose being to prevent the pulling of a vacuum.

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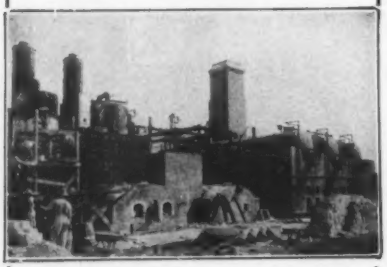
An Authority on Oil Still Construction Says:—

"High temperature cement has to a great extent taken the place of fire clay in recent years, especially where extremely high temperatures are required. This cement is applied between the brick in the form of a paste and a thin layer is spread over the face of the brick. After the furnace has been fired, this cement unites the brick into a solid wall, and forms a glazed surface over the brick, thereby protecting the brick from disintegrating under the extreme heat."



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(Reg. U. S. Pat. Off.)

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400 pounds will lay 1000 brick

HYTEMPITE is warehoused at or near all oil fields and industrial centers for immediate delivery.

Instruction booklet HO-109 on request.

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INCORPORATED

26 Cortlandt St. New York

justify our efforts. The foreman who sits on the nail keg and tells the gang what to do is only half the foreman that the chap is who gets at the head of his men and shows them how to do it and do it safely.

Individual Training for Every Worker

We have found that the practice method is the one that gets the best results, and it puts it squarely up to the worker after that, and our special investigating committee has a clear conscience when they go digging into the details of a lost time accident in which the worker did differently than had been shown him. I'm sure we all want safe workers, but we can never get them by circularizing them—we have got to give them some training, some individual training, and if we expect to develop our plants where the gallons will be in terms of millions and the man hours in terms of one, we have got to bear down a bit harder on this practice method.

The question may arise in your mind as to what part the safety engineer plays in our program, and in passing it might be well for us to consider just what this safety engineer is and what his function is. I predict that the time is not far distant when the real meaning of safety engineer is going to spread out and clothe all the foremen in every industrial plant, and from thence to every worker of the plant.

At Port Arthur works, when you speak of the safety engineer you may be referring to Tony Randazzo of the bull gang or your reference may be to the assistant superintendent, for we contend that every man on the works is a safety engineer, and our aim is to educate every worker to the point where he is fully aware of carrying this responsibility. We appreciate the fact that to make our plant "the safest oil refinery in the world" means that we have got to be possessed of just that kind of a crew, and the molding and reshaping of two thousand men as such is by no means a one-man job.

It may be contended that the safety engineer directs the work in connection with safe appliances and practices. Perhaps so, but if such is the case on our plant, you can then say that the general superintendent is the safety engineer, for he is the gentleman who cuts the safety pattern. No safety engineer can do much directing or guiding unless he has the unstinted support of the management, and it is impossible for me to conceive of a general manager or superintendent, who is largely responsible for thousands of workers eight hours out of the twenty-four, who is not vitally and personallly interested in guiding the well being of these human machines.

And so I claim that in any plant, the so-called safety engineer if set up as such, is but a figurehead—a name on the payroll, and he can suggest, he can advance theories, he can issue instructions, he can post edicts and notices, and he can day dream in his well appointed office but he will never decrease the cost of compensation, add to the general efficiency of the plant, or materially increase the well being and happiness of the workers or their families, simply because he can't cover the field as a one-man proposition. In any plant, there should be no stopping point in the meaning of safety engineer from the general superintendent to the road sweeper, for safety can only be worked out successfully through a mutual faith and a common understanding that industrial hazards are obstacles whose removal requires management.

And so, in our plant we already have the united effort of both men and hundreds of qualified safety engineers —qualified because they believe in the company they work for—because they believe in the principles of a safety program—because they believe they will be rewarded for their efforts—and because they unselfishly believe in their fellow worker and humanity, and we have thousands of safety engineers in various stages of development.

At Least Two Safety Ideas Daily

Often, when I pick up the daily paper, I am inclined to wish that there was some imaginary giant whose voice was powerful enough to call the entire world to a state of attention and entertain a motion to the effect that every earthly inhabitant would resolve to associate at least two safe ideas each day. The Boy Scouts produce good men through the performance of one good turn each day, and I'm sure that if the spirit of the thing could be generally put over, we could make our accident situation, in general, almost unbelievable if we could but get people to have at least one association of safe ideas each day. And it comes back to the question of personal contact and training.

Phillips Buys Another

Breckenridge, Texas.—The Phillips Petroleum Company has purchased the natural gasoline plant being erected by Barney Carter and associates in the Barney Carter pool in lower Stephens County, and will place the plant in operation before October 1. The plant is equipped with seven 150-horsepower units, and will derive its gas supply from 12 completed oil wells in the pool, while additional gas has been contracted for by Phillips from wells located several miles from the pool.

To Move Refinery

Enid, Oklahoma.—The Miller Boiler and Tank Company has bought an abandoned refining plant at Ardmore and will move it here to be rebuilt and put in running condition. This is a new concern, T. L. Miller of Enid being president, J. H. Hawkins of Covington, vice president, and J. J. Allen of Enid, secretary.

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Tank Settlings and Debris Coke
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New Processed Fuel Yields
Over 18,000 B. T. U.'s per pound
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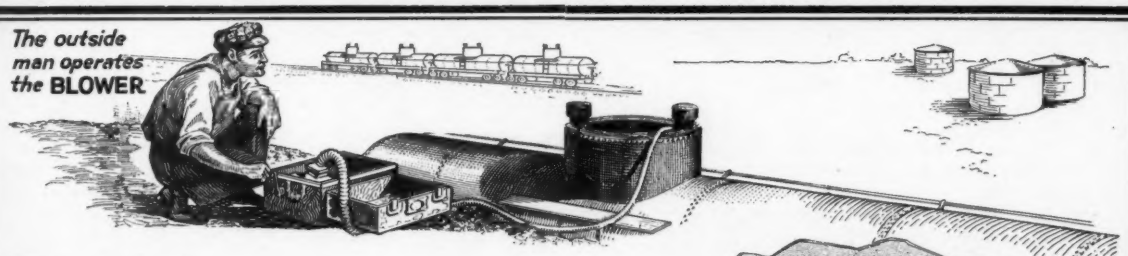
ASPHALT * TAR * BITUMEN

Plants Designed and Operation directed by expert in the field.

PREMIER MILL CORPORATION
GENEVA, NEW YORK, U. S. A.

Basic U. S. Patent No. 1,523,632
Basic Canadian Patent No. 244,685



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Standard for the American Gas Association

Tell them where you saw the ad.

Charcoal Process Proves Efficient On Casinghead Gas

AN innovation in the production of natural gasoline has recently been instituted by the Skelly Oil Company, at their new wildcat well location northwest of Stroud, Oklahoma. When the well came in a few weeks ago, it began producing some twelve hundred barrels of high gravity oil, and over a million cubic feet of casinghead gas. The gas was immediately tested with a compression test car and found to have a high content of gasoline. While it seemed there was too much gasoline to permit it to blow into the air, it did not seem possible to erect a plant for the recovery of gasoline without taking an unusual gamble. There was no other producing well in the vicinity, and no indication as to what might be expected in the way of casinghead gas production from offset wells to the producing wildcat.

The Skelly Oil Company management decided that it would not be a sound, economic policy to begin the installation of a large plant until the size of the field was more definitely determined. However, they decided to conserve as much of the natural gasoline as possible by a method which had not previously been used on a large scale in this field on rich casinghead gas, namely, the charcoal process. The company owned a charcoal plant which had been installed in their Burbank field to treat the residue gas of one of their oil plants. Due to the drop in the volume of gas treated at the Burbank oil absorption plant and the resulting increase in the oil plant efficiency, there was not sufficient gasoline left in the residue gas to warrant the operation of the charcoal plant. They, therefore, decided to move this plant immediately to the Stroud well, and set it up in a very temporary manner, to treat the casinghead gas from the well, until further developments in the field indicated whether or not a larger plant should be installed. Short work was made of the moving job, since the equipment was very compact and simple. The erection of the plant at the new site was also made in record time. Only eight days were required for moving the plant on trucks, a distance of nearly one hundred miles, and erecting it again on the new location.

On Wood Foundation

All equipment was set up on wood blocks, there being no concrete foundations in the whole plant. The plant consists of three absorbers filled with activated carbon so connected that the gas can be passed through two in series, while the third one is being distilled. The absorbers are horizontal tanks, six feet in diameter, and eight feet long. Condensers are made up of pipe coils supported on pipes driven into the ground. These condensers are mounted over a small condenser pit made by digging a shallow basin in the ground. On the bank of the basin, a duplex water pump was installed to pump the water from the basin and spray it over the coils. A small steam driven vapor compressor mounted on skids, handles the vapor from the plant. Steam is furnished by two small oil field boilers. A small Braun Gas Cooler is used to cool the gas after it passes through the plant before it is returned to the residue lines to furnish fuel for the lease. The gas from the well is passed through a separator for removing the oil, and then through a scrubber tank after which it enters the charcoal plant at some five to seven pounds pressure.

There was no change in the method of operating the plant from that used on residue gas. The charcoal plant had been rated at 750 gallons daily production, by the Gasoline Recovery Corporation, who furnished the designs for the original plant, and under whose license the plant is being operated. They had so designed the plant that it was capable of carrying an overload of 100 per cent when treating gas of low gasoline content. As soon as it was realized that the plant would be badly overloaded under the new conditions, the operation was speeded up so that one cycle was made every thirty minutes. The plant began immediately producing at the rate of 2500 gallons per day.

Recovery High

At the beginning of the operation, a million cubic feet of gas was treated. This gas was tested by a compression test car and showed a net yield of 2.28 gallons per thousand cubic feet. A test on the residue gas from the charcoal showed .04 gallon per thousand cubic feet. At a later date these tests were repeated on two occasions by running check tests by the charcoal method on the inlet and outlet of the plant. The charcoal inlet tests averaged 2.5 gallons per thousand cubic feet, and on some of the residue tests no condensate whatever could be obtained. The highest test obtained on the residue gas showed a content of .066 gallon per thousand cubic feet of 92 gravity gasoline. The average of residue gas tests has been less than .03 gallon per thousand cubic feet. This is exceptionally good operation when it is considered that the plant is running at better than 300 per cent of its rating.

The first gasoline produced at the plant had a gravity of approximately 86 degrees A. P. I. and showed a recovery in excess of 93 per cent on the distillation test. After the plant had been in operation for a few days, cooling conditions were improved, and the pressure at which the vapors were compressed in the recompressor was raised so that the product was approximately 88 degrees A. P. I. gravity. A distillation test on this gasoline was as follows:

Gravity— 88.1° A. P. I.
I. B. P.— 75° F.
10— 84
20— 93
30—102
40—109
50—122
60—136
70—158
80—190
89—265 End Point
Residue .6 cc.
Condensed and received at 32° F.

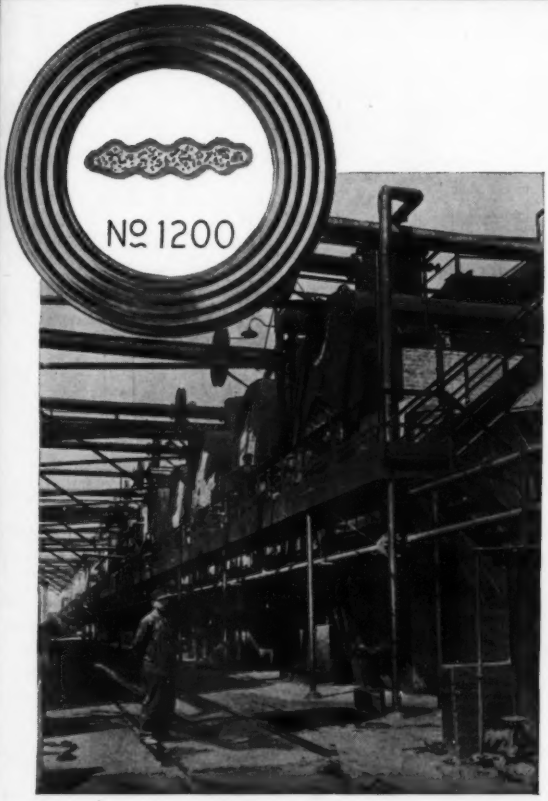
By producing gasoline of this quality, the plant shows a net yield of about 2.7 gallons per thousand cubic feet. It will be noted that this recovery is quite a bit in excess of the recovery indicated by the charcoal tests on the gas treated.

Portable Possibilities

The water that is used for the condensers has a temperature of from 100 to 110 degrees F. in the pit on hot days, and this is pumped and sprayed directly over the coils, which at times gives rather poor cooling. On the whole, however, the operation has been as good as conditions would permit, and it has been even more satisfactory than anyone connected with the venture had expected.

It has always been said that the charcoal process, by virtue of its simplicity of design and operation could be most readily adapted to a portable plant. While, of course, this particular installation was not designed for a portable plant, one cannot see it in its present location without being impressed with the possibilities of a charcoal plant along this line. The absorbers are now only half filled with charcoal, the absorber unit having been designed for a plant twice the size. If they were only large enough to contain the charcoal that is now in them, it would be an easy matter to haul all three of them. The three absorbers, charcoal, and the piping for a plant of this size would weigh less than ten tons. If some inclosed type of condenser were used, the condensing equipment could all be mounted in a very small space and it would weigh even less than the three absorber units. The operation of the Skelly Plant proves, conclusively, that this is not only possible, but entirely practical.

In addition to the simplicity of the apparatus used, there are some points in the operation of the plant that fit it admirably for a portable installation. Most portable plants will be operated on well pressure and it is usually necessary to treat the gas at a very low pressure. The charcoal process is just as efficient at low pressure as at high. It will operate just as efficiently at five pounds as at fifty pounds, and in this particular, it has



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Withstand oil at high temperature and high pressure. Goetze Gaskets give efficient service insuring against leakage and fire risks.

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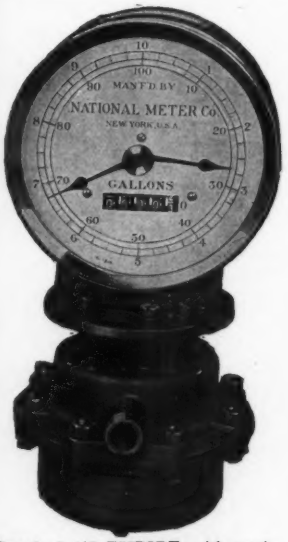

Standard 1½" EMPIRE, with vertical dial that can be turned to any one of four positions

OILMETERS
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A positive displacement device, operated by an oscillating piston. Different from every other type. Easy to install and maintain, and unequaled for accuracy that lasts.

Sizes ⅝" to 6"
Both standard and high pressure models

All styles and sizes fully described and illustrated in circular 110-R. Send a postal for your copy.

Special 6" high pressure EMPIRE, with horizontal straight-reading register

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Chicago Boston San Francisco Cincinnati Atlanta Los Angeles

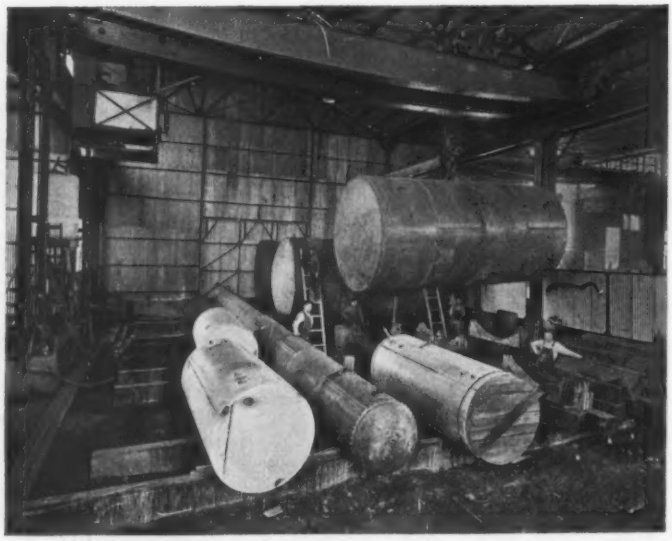
Tell them where you saw the ad

a decided advantage over an oil absorption plant. If, due to failure of gas pressure, it becomes necessary to pump the gas through the plant, it would only need to be pumped to a pressure of three or four pounds, and this could be done very conveniently with a simple blower installation. From the economic standpoint, it is interesting to note that on this particular plant, sufficient gasoline was produced during the first week of operation to pay for all expenses incurred in moving the plant from its original location to the well.

Stable Gasoline Produced

Another striking feature of the plant is the quality of the gasoline made. The inherent ability of the charcoal process to produce stable gasoline was never more apparent than on this installation, treating casinghead gas. A recovery of 88 to 90 per cent on the total production of gasoline from a plant that is showing a yield of several percent in excess of the charcoal test, is a record that cannot be lightly considered. This is a stable gasoline made in one simple operation, with an efficiency of extraction that can not be rivaled by any combination of installations.

The most important outcome of the operation of the plant, in so far as natural gasoline industry is concerned, is the exploding, once and for all, of the popular myth that the charcoal process could not be worked on casinghead gas. It had been used on a small scale with casinghead gas several years ago in some of the Eastern fields, and in the Mid-Continent field more than two years ago. However, it remained for the Skelly Oil Company to prove on a large scale installation the contention of the Gasoline Recovery Corporation, that there is a large field in the charcoal process on casinghead gas. It is a well-known fact that an oil absorption plant can be operated at 300 per cent of its rating, and still recover 75 or 80 per cent of the gasoline in the gas. This wildcat plant has demonstrated that a charcoal plant will carry a corresponding overload with much higher efficiency.



View of Wyatt's DALLAS Test Floor

The reputation a manufacturer has with his trade is built upon character. If the reputation is good the character of the organization in its adminstration, its operatives and its physical equipment will be found to be of the best. The purpose and will to do good work may be inherent but without the facilities the results will be unsatisfactory.

The facilities for testing shown in the above cut are representative of the care and thought that have been given to the equipment of the entire shop for building up the excellent reputation which this company enjoys thruout the entire Southwest in every branch of the Oil Industry where plate work is used.

Wyatt Metal & Boiler Works

Dallas, Texas

Committee D-2 Will Meet in Tulsa

Tulsa, Okla.—For the first time, committee D-2 of the American Society for Testing Materials is to hold one of its sessions in the oil country. This is the committee charged with determining the standards for testing apparatus and procedure in the manufacture of petroleum products.

Sessions will be held October 5 and 6, the committee having selected dates that will give its members an opportunity of getting a close-up of the oil industry because of the International Petroleum Exposition and Congress. The committee has around 90 members, half of whom are expected for the Tulsa session.

While in Tulsa the committee will be entertained by the Western Petroleum Refiners Association. A dinner the night of October 6 has been arranged by the Technical committee of the association. The Technical committee met in Tulsa September 17 to make arrangements. Those attending were C. L. Henderson, Vickers Petroleum Company, Wichita, Kansas; F. B. Koontz, Mid-Continent Petroleum Corporation, Tulsa; H. W. Camp, Empire Refineries, Inc., Tulsa; Walter Miller, Marland Refining Company, Ponca City; Lloyd F. Bayer, Tidal Refining Company, Tulsa; W. E. Perdew, Derby Oil Company, Wichita; and J. A. Sartori, Producers & Refiners Corporation, Tulsa.

If memebrs of committee D-2 desire, a trip to the fields near Tulsa will be provided by the Western Petroleum Refiners' Association, through its Technical committee.

Nothing has been given out relative to the object of the meeting of committee D-2 in Tulsa. But the Western Petroleum Refiners' Association has since its last convention been seeking a change in the apparatus for testing motor gasoline.

At its meeting in 1923, Committee D-2 determined on removal of cotton from the thermometer bulb when making distillation tests on motor gasoline. No change was made in specifications for U. S. Motor gasoline.

The following is from a letter ad-

Cars of a thousand uses

IN six great plants distributed over the U. S., we design and manufacture cars for sale or lease to suit every individual need. Cars specially adapted to ship each product most economically.

Cars equipped with heater coils of latest engineering design immediately available for lease service.

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Southern Office:
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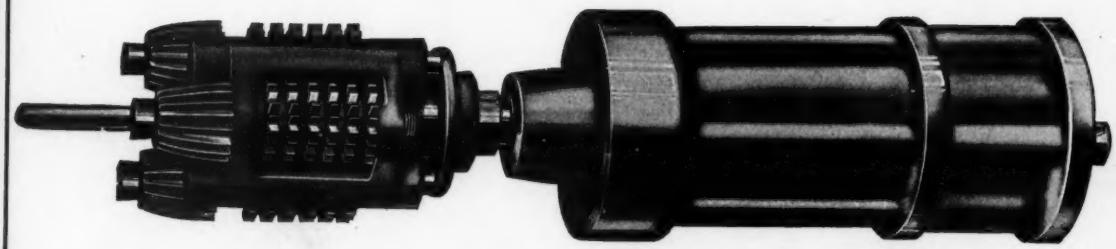
GENERAL AMERICAN TANK CAR CORPORATION

General Offices: ILLINOIS MERCHANTS BANK BUILDING, Chicago, Ill.

PLANTS: East Chicago, Ind.; Fort Worth, Texas; Warren, Ohio; Sand Springs, Okla.; Good Hope, La.; Wichita Falls, Texas

Cleaners for Cracking Still Tubes Must Be Powerful·Fast·Thorough·Durable



ROTO TUBE CLEANERS

Direct Inquiries to—

The Roto Company
HARTFORD, CONN.

dressed to the Federal Specifications Board relative to this matter, the letter being sent by the Western Petroleum Refiners' Association:

"It is generally conceded that the elimination of the use of cotton on the thermometer bulb tends to make the reading of the thermometer from three to six degrees higher through substantially the same distillation range, and a number of the members of the Western Petroleum Refiners' Association, who have investigated the subject, believe there is an average difference, stated conservatively, of four degrees.

"Those members of our association who have worked on this problem substantially agree that this difference in distillation points means a reduction in yield of straight run gasoline from the crude oil of approximately one per cent and also reduces in similar proportion the yield of gasoline from cracking processes. Based on gasoline this would mean a reduction in gasoline production of from two to four per cent."

It is likely that this question will have consideration at the coming meeting in Tulsa.

Change in Company

By agreement, effective June 15, 1925, the Cross-Widdell Engineering Company of Kansas will be dissolved upon completion of outstanding contracts undertaken by it prior to that date.

H. E. Widdell, formerly partner in the Cross-Widdell Engineering Company, has acquired the company's assets and is carrying out its contracts, without, however, having acquired the corporate name of the Cross-Widdell Engineering Company.

In stead of the company above, the engineering department of the Kansas City Testing Laboratory will conduct a general engineering business.

Changing to Absorption

Tulsa, Okla.—Sinclair Oil & Gas Company is converting its Garber compression natural gasoline plant into one of absorption type. The plant is in the southwest quarter of section 19-22-3 west. When complete will be able to handle 20,000,000 cubic feet of gas daily. The output should run close to 60,000 gallons. Output of the compression plant was 30,000 gallons daily. The work should be completed by January 1.

Suit Filed on Stabilizer Patent of Phillips Company

Tulsa, Okla.—With the filing of a suit in Delaware, action leading to the "clarifying of the stabilizer patent situation" has been started. The suit in question has been filed by the Carbide & Carbon Chemicals Corporation of New York, the Phillips Petroleum Company of Bartlesville being made the defendant in the action.

The Phillips company has until October to file answer to the suit, which is expected to go through a long process before final settlement is reached.

The stabilizer patent suit has been brewing many months. The stabilizer patented by the Carbide and Carbon Chemicals Corporation came into use early in 1923. Subsequently other patents were issued, the last being granted to the Phillips Petroleum Company early this year, the number being 1,520,627.

The Phillips patent was originally asked by M. P. Youker, formerly with the United States Bureau of Mines at the Bartlesville experiment station. It was bought by the Phillips Petroleum Company, except for use by the United States government.

Tulsa Office Opened

Wichita, Kans.—The Western Iron and Foundry Company of Wichita announces the opening of a Mid-Continent sales office at 217 Ault building in Tulsa to be in charge of Albert Golden, formerly associated with the Republic and Jarecki supply companies.

The Western Iron and Foundry Company are manufacturers of refinery and natural gas plant equipment.

Tank Car Leasing

with genuine auxiliary service

Considered in the light of car leasing alone, North American service is unsurpassed. A fine fleet of cars, every one in tip-top shape, assures complete satisfaction at all times.

Add to this main service the auxiliary service that we offer and you begin to understand the constant growth we have enjoyed.

Three fully equipped repair shops; oil storage facilities (with warehouse receipts) at Chicago, Tulsa and New Orleans, and a car part service whereby draft gear parts, safety valves, brake shoes, arch bars, etc., are shipped immediately from stock—constitute a service that it pays to investigate.

May we send you full details on the service we offer to shippers of oil?

Car Repair Shops
Chicago
Coffeyville, Kan.
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Chicago
Tulsa
New Orleans

North American Car Co.
327 S. LaSalle St., Chicago, Ill.
Petroleum Bldg., Tulsa

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Vogt Wax Press Plates have been developed from actual wax plant use and practice. Materials are the best that can be bought. Workmanship the best that long experience can develop and the inspection is rigid.

There are two types, tight and loose ring, as shown. Bulletin RE-2 tells more about them, also other Vogt refinery equipment.

Tight or Riveted Ring Type

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INCORPORATED
LOUISVILLE, KY.

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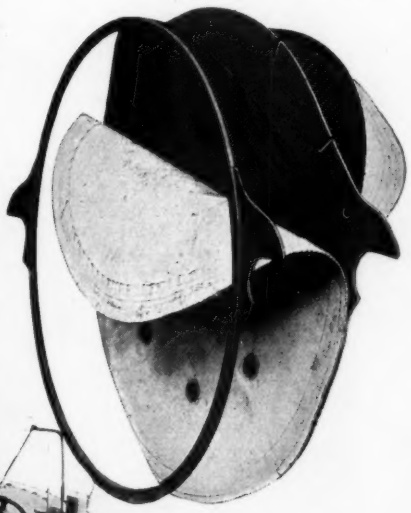
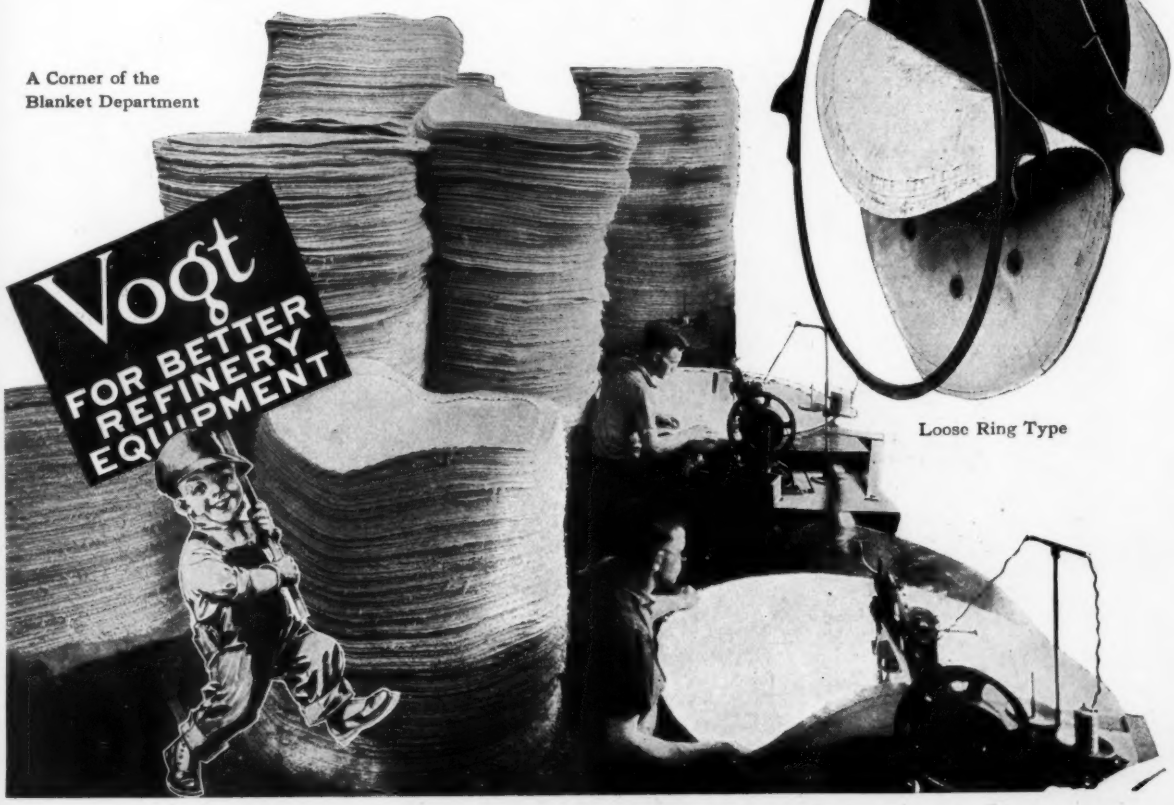
Manufacturers of: OIL REFINERY EQUIPMENT, WATER TUBE AND HORIZONTAL RETURN TUBULAR BOILERS, DROP FORGED STEEL VALVES AND FITTINGS, ICE MAKING AND REFRIGERATING MACHINERY.



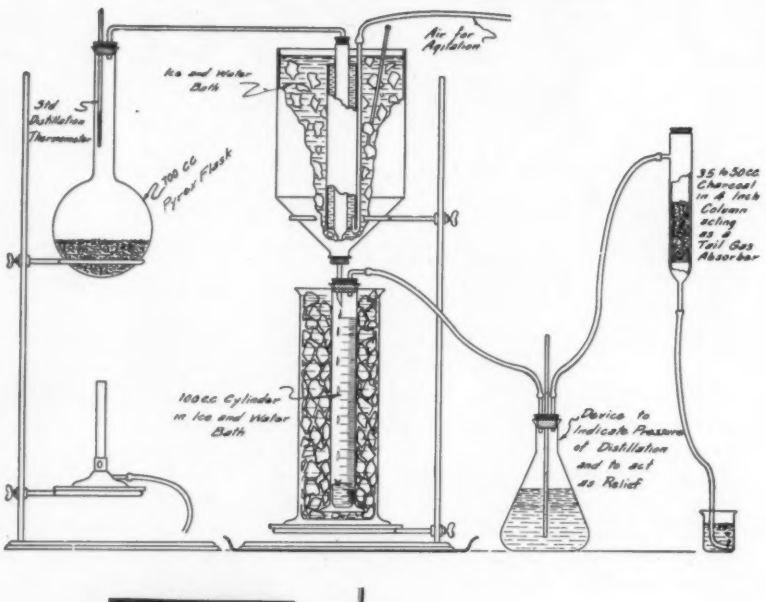
Loose Ring Type



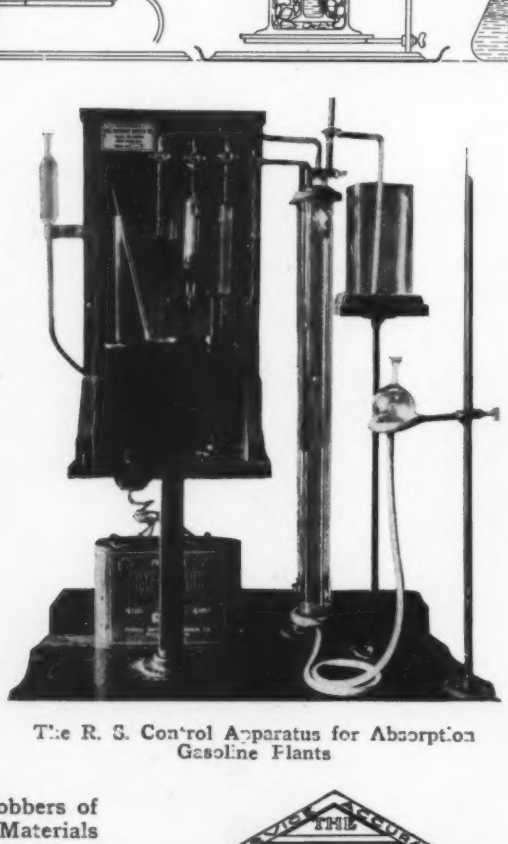
A Corner of the Blanket Department

Tell them where you saw the ad.

Complete Charcoal Distillation Apparatus
With Tail Gas Absorber


Air for Agitation
Ice and Water Bath
Std Distillation Thermometer
700 cc Pyrex Flask
35 to 50 cc Charcoal in 4 inch Column acting as a Tail Gas Absorber
100 cc Cylinder in Ice and Water Bath
Device to Indicate Pressure of Distillation and to act as Relief

Alligator
Oil Thief



The R. S. Control Apparatus for Absorption Gasoline Plants

The R. S. Charcoal Tube Adaptor

Largest Jobbers of Scientific Materials in the Southwest

Catalog on request

THE R.S.C. TULSA

Complete Line
TAG
Oil Testing
Instruments

THE REFINERY SUPPLY COMPANY, Tulsa, Okla.

REFINERY AND GASOLINE PLANT ACTIVITIES

New Viscosity Bath

The Emil Greiner Company, 35 Vandam St., New York City, N. Y., is announcing a new Viscosity Bath, said to have superior qualities.

This Greco-Mowen Viscosity Bath, as it is called, is the result of a development by Laboratories of The Texas Company that embodies a number of new features which have been tested for practicability.

The bath is heated by ruggedly built electric heating elements placed to conform to the latest specifications of the A. S. T. M. Temperature control is maintained by a thermostat panel operated by a mercury thermostat of special construction.

A feature of the control panel is the specially wound relay which is operated by such a small amount of current that arcing is eliminated as a consideration. The current passing through the relay is first reduced by a special coil wound for the purpose. The relay operates a contact device, controlling the heating elements, and the passage of current is indicated by a small lamp. The necessary electrical fixtures are provided. The whole arrangement is practically foolproof and provides automatic temperature regulation which is a time saving feature that greatly cuts down operating costs.

With proper attention to the preliminary setting, a maximum temperature variation of plus or minus one-tenth degree F. from the fixed point is obtainable.

The bath operates equally well at all the standard temperatures at which viscosity determinations are measured, 100, 130, and 210 degrees F.

An automatic electric stirring device which is compactly built in as a unit provides an important feature. The stirrer is so placed that perfect circulation is assured and since this operates continuously at a definite rate, the personal equation is entirely eliminated.

The bath is so designed that the standard Saybolt flasks fit under it with just the correct amount of clearance.

Additional information may be had upon application to the company.

Texas Office Opened

Fort Worth, Texas.—The American Gasoline Corporation has established an office on the sixth floor of the Burkburnett building in Fort Worth in connection with the expansion of its operations to Texas. This concern has erected Newton type of absorption plants in Stephens County and also in the Waskom field, Texas, and is closing gas contracts for three more plants in the state. Thomas Ryan is superintendent in charge of the Texas operations, with J. E. Walsh as first assistant. The American Gasoline Corporation maintains headquarters at Los Angeles, California, and is capitalized at $10,000,000.

Plant Operating

Wichita Falls, Texas.—The 2500-barrel daily capacity skimming plant near Wichita Falls formerly known as the Wichita Refining Company and Keystone Ranger Refining Company has been acquired by the Wilson Brothers Oil Refining Company and replaced on the active list of plants. The new owners of this plant were incorporated under the laws of Texas with a capital stock of $30,000 last August. Charles L. Wilson, Eugene F. Griswold and H. T. Jones are officials of the company.

Tank Car Company Opens Office in New Orleans

New Orleans, La.—Southern sales offices of the General American Tank Car Corporation have been established at 1022 Union Indemnity Building, here, in charge of Z. R. Simon, Southern Sales Manager.

In a recent announcement the company also called attention to its new plant at Good Hope, Louisiana, which is in operation now and is fully equipped with all modern facilities, enabling maximum efficiency to be given in overhauling and repairing all types of tank cars.

This plant will also carry a complete stock of standard car material and tank car parts, available for prompt shipment.

The company extends a welcome to its patrons in the south to visit the New Orleans office.

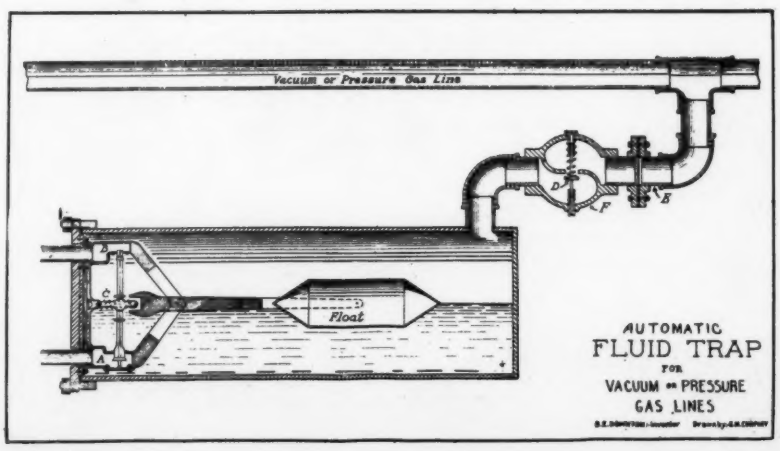
Automatic Fluid Trap

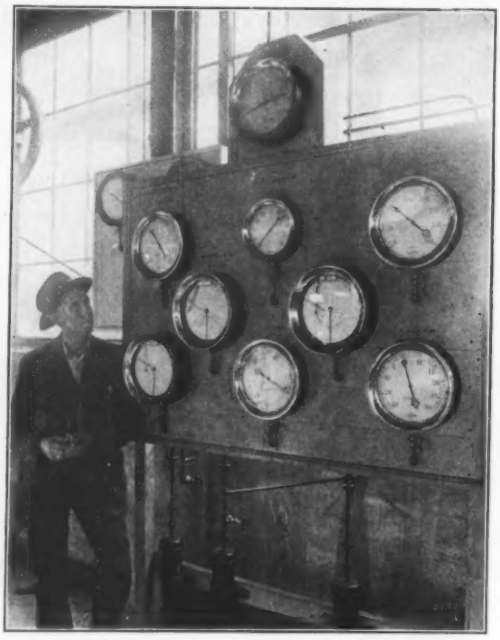
The automatic fluid trap for vacuum or pressure gas lines, shown in the accompanying illustration, is the invention of B. E. Downton of Dewey, Oklahoma. The device is in successful operation in Mid Continent natural gasoline plants.

The following description has been given by the inventor:

F is a special valve through which fluid enters trap chamber from gas lines, or scrubber tanks. B is residue gas inlet valve to trap chamber; A is fluid discharge valve to atmosphere; C is fulcrum bearing for tripping device which gives positive action either up or down, the tripping device being actuated by float arm; D is ⅛-inch hole through valve disc, and E shows shut off gate valve to be inserted. The operation is as follows:

With float at lowest position, valves A and B are in closed position, and valve F is open. A vacuum now being established in trap chamber, fluid will enter. As fluid level rises valves A and B are eventually knocked open by tripping device, valve F automatically closes and vacuum is broken in trap chamber, residue gas enters valve B, and forces fluid out of valve A. As fluid level drops, valves are eventually knocked closed, by tripping device. Vacuum is now re-established in trap chamber through hole D in valve F. Valve F will then automatically open and allow more fluid to enter trap chamber and cycle is repeated as long as there is fluid to be received. All parts inside of trap chamber are of brass or bronze, and are removed, as a unite with end plate. Trap chamber is made of 12-inch pipe.





One of Twenty

A good example of the widespread use of Foxboro Instruments in the oil and natural gas fields of the country is the Foxboro Gauge Board shown above. It is but one of twenty compressor plant gauge boards used by the Shell Company of California at Long Beach.

Here on this Gauge Board is centralized all the information of plant operation. These Foxboro instruments are even more dependable than the human brain. They do not fatigue. They are sensitive to the slightest variation of vacuum or pressure every minute of the day and night, and this accuracy is maintained for the life of the instruments. Write for complete information.

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Oil Testing Instruments In New Orleans

The complete Tagliabue line of Scientific Instruments is carried by us right here in New Orleans. The prices are the same as the factories. You save the difference in transportation charges and time.

Send for complete Catalog—Free.

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The Largest General Supply House South Since 1867
NEW ORLEANS, LA.

Gasoline Committee to Report on Testing Code

Tulsa, Oklahoma.—A committee of the Association of Natural Gasoline Manufacturers is now studying the code proposed by the Natural Gas Association of America for the testing of natural gas. The code was proposed as to specifications and methods of testing.

When the committee of the gasoline body makes its report, the matter will be given to the membership of the association for final approval or rejection.

Those on the committee are A. J. Schlosser, Barnsdall Oil Company, chairman; O. S. Ambrose, Tidal Refining Co.; W. H. Harts, Amerada Petroleum Corp.; Ray Short, Prairie Oil & Gas Co.; E. C. LeFevre, Empire Gasoline Co.; George Bunn, Phillips Petroleum Co.; J. H. Boyle, Chestnut & Smith Corp.; J. J. Thomas, Skelly Oil Co.; Elmer Schmidt, Lone Star Gas Co., and P. M. Childer, Marland Oil Co. In addition W. A. Melton of the J. A. Hull Co., a non-member, who had a part in the compiling of the original proposed code, is serving on the committee.

Two Plants for Panhandle

Tulsa, Okla.—The American Gasoline Company of Fort Worth and Los Angeles are constructing two natural gasoline plants near Panhandle, Texas. One plant will be natural pressure and the other is being equipped with a battery of six Clark direct driven compressors sold by the Gas Engineering and Construction Company of Tulsa, sales agents for Clark Brothers Company of Olean, New York.

Five 165 H. P. Clark vacuum pumps and compressor units also have been sold by the Gas Engineering and Construction Company to the Gilliland Oil Company who are making enlargements to their palnt at Louann, Arkansas.

The Phillips Petroleum Company has purchased ten Clark 165 H. P. compressors and vacuum pumps from the Gas Engineering and Construction Company for the large gasoline plant Phillips is building near Beggs, Oklahoma.

Brown Instrument Company Opens California Office

Los Angeles, Calif.—The Brown Instrument Company, Philadelphia, Pennsylvania, manufacturers of pyrometers, thermometers, tachometers, and other indicating and recording instruments, announces the opening of a branch office at 363 New High Street, this city. S. F. Godfrey, formerly with the Braun Corporation, will have charge of the store in the capacity of district manager.

Articles of incorporation have been filed in California, and the branch store will carry stock and conduct its own accounting direct with its customers.

A complete repair department is maintained and customers are assured of thorough Brown service in every way.

Process Found for Generating Gas from Refinery Sludge

New York, N. Y.—Announcement of the development of a new process for manufacturing non-poisonous heating and illuminating gas from "sludge" and refinery residuums has been made by the Gas Bond and Share Corporation of America, through its president, Colonel E. E. Garrison. The gas is said by technologists and engineers who have tested it to contain more than 1000 B. T. U.'s per cubic ft.

The process is the invention of Orestes U. Bean, inventor of the Bunsen Furnace. It has been developed by Colonel Garrison and a group of well known petroleum technologists including George B. Gifford, former chief engineer of the Standard Oil Company, and Vincent G. Shinkle, designer and operator of many of the largest existing compression gasoline extraction plants.

Product Generated

According to the engineers who have studied it, among whom is Alexander B. Way, former chief engineer of the Boston Consolidated Gas Company, the Bean process generates a gas which is not only non-poisonous, because of the absence of low heat value carbon-oxygen combinations, but which tests very rich in illuminants and gasoline content. Any kind of gas for domestic and industrial uses can be manufactured by the process.

Briefly stated, the Bean process produces a carburetted water gas generated in a continuous tube or conduit so arranged that diameters and temperatures vary to suit the work. Under controlled temperatures, which range from 780 degrees F. to the temperature of gas fixity, the most valuable combinations of hydrogen and carbon are formed. Oxygen and carbon, it has been found, do not unite at these temperatures, and as a result the gas runs as high as 56 per cent. illuminants in which there is a heat value of 2230 B. T. U.'s per cubic ft., and 32 per cent methane with a heat of 1009 B. T. U.'s per cubic ft.

The report of Alexander B. Way, following his investigation of the Bean process plant at West Babylon, L. I., listed the following "pleasing features" of the process:

"The combination of boiler, carburettor and superheater in one unit; the small space occupied—not more than 150 cubic feet, for a 10,000 cubic ft. per hour generator; the practicability of installing in existing gas plants without disturbing the present layout—simply connecting with the existing condenser when ready to make gas; the almost insignificant cost of construction per unit volume of gas produced; the very few men necessary for operation; the elimination of solid fuel and its accompanying cost of handling, the cheapening of cost of purification of the gas,

FOR CLEANING INSIDE
Tanks—Vats—Tank Cars
With Safety Use the

Pulmosan Airline Mask

Complete protection for the operator, using fresh air at all times.

Arms, Legs and Body always free to work with.

Furnished in neat durable carrying case.

Larger outfit can be supplied with light blower and durable case for extra heavy work.

Prices and Literature on Application

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This sectional cut of Metallo Valve Disc shows the construction

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A Leaky Valve Is a Liability

"Metallo" Valve Discs Stop the Leaks—Give Perfect Service.

Made of the highest grade of Asbestos, ENTIRELY ENCLOSED in a jacket of the best copper, scientifically annealed. At no point does the asbestos come in contact with the pressure.

"Metallo" Is the Only Valve Disc Entirely Enclosed in Copper

That explains why it will outlast six ordinary discs.

Send for Booklet and Prices

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HOUSTON, TEXAS

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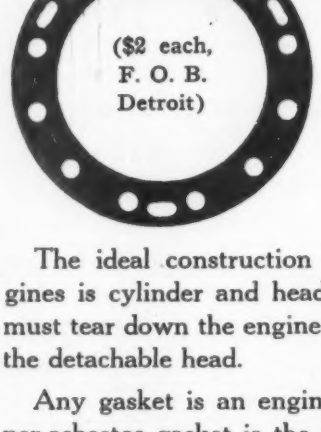


A Copper Asbestos CYLINDER HEAD GASKET
For Bessemer 80's

The ideal construction for internal combustion engines is cylinder and head cast in one piece; but you must tear down the engine to get at the pistons. Hence, the detachable head.

Any gasket is an engineering compromise. A copper-asbestos gasket is the most satisfactory solution so far.

McCORD RADIATOR & MFG. CO.
Gasket Division
DETROIT, MICHIGAN
Manufacturers of McCord Force Feed Lubricators

the ability to use the cheapest grade of oil instead of the usual high grade gas oil; flexibility in the matter of changing the quality or quantity of the gas in a moment; the high quality of gas obtainable and last but perhaps greatest in importance at this time, the extremely low cost of production."

No Residuum

The gas is produced, he added, just as well with a 3 cent fuel oil as with a 6 cent gas oil. These materials are completely gasified leaving no residuum.

Colonel Garrison, persident of the new company, says of the operation:

"The operation embraces no new or unrecognized chemical or physical principles. Its novelty consists in the assembly of all important reactions between the carbon of the oil and the dissociated hydrogen or superheated steam in a practical, almost automatic apparatus so constructed as to permit their full functioning.

"In short the process may be characterized as final from the standpoint of chemistry in that the materials are utilized at their highest efficiency both from the standpoint of the direct product, which is high heat gas, and beginning with rare quality gasoline from the standpoint of by-products and ending, we do not yet know where."

Transcontinental Moves Nearer Refining Plants

Tulsa, Okla.—In transferring headquarters from Pittsburgh to Tulsa, the Transcontinental Oil Company is making it possible for executives to keep in closer touch with refining activities. The company has three refining plants in the Mid-Continent area, one at Bristow and one at Boynton in Oklahoma, and one at Fort Worth.

F. B. Parriott, president; T. R. Crowell, vice president, and A. B. Daily, director, will make their homes in Tulsa. C. H. Huston, chairman of the board will maintain headquarters in New York.

The sales office will be maintained in Pittsburgh.

Hearing Date Set

Austin, Texas.—The railroad commission Saturday set for hearing October 13, application of the North Texas Petroleum Traffic bureau of Fort Worth, for a revision of regulations, so as to allow mixing or blending in transit of naphtha and natural gasoline in tank cars at refining points in the state.

Walter W. Louis, for several years driller for the Rio Bravo Oil Company in Texas, and head driller on the Settegast No. 1, recently completed as an extension to the Pierce Junction field, near Houston, has been made field foreman for the company. Louis has been following field work for the past 25 years, and has been in the employ of the Rio Bravo since 1918.

Taxing Gasoline a Growing Habit

A SURVEY recently completed by the Wall Street Journal reveals a growing tendency to make gasoline the vehicle for collecting taxes in the United States. There are now 44 states having some tax on gasoline sales. The minimum is 1 cent a gallon, the maximum 5 cents.

According to the estimates of this financial journal, taxes on gasoline will yield $139,905,242 in 1925. Most of this is collected for the maintenance of highways.

In this connection it is interesting to note the growth of the taxing of gasoline in the states. In 1919, only four states had a tax on gasoline. The growth of gasoline taxation follows:

Years	No. of States	Gross Receipts
1919	4	$ 553,987
1920	5	1,475,136
1921	13	5,302,259
1922	18	11,923,442
1923	35	36,813,939
1924	35	79,734,490
1925	14	*139,906,242

* Estimated.

The average tax for 1925 is 2.44 cents a gallon, while in 1924 the average tax was 1.81 cents a gallon.

The Wall Street Journal makes this statement concerning the average tax: "Average gasoline tax equals about 15 per cent of the average tank wagon price of 16.34 cents a gallon, exclusive of tax, in 30 representative cities, prevailing as a result of recent reductions."

The tendency in adding a tax to the price of gasoline is upward. Only four states levy 1 cent a gallon, while 5 cents is collected in only one state, South Carolina. But 4 cents appears twice in the list. There are only four more states to vote taxes on gasoline but evidently there is no limit to the amount a state legislature will put on gasoline as a tax.

The result of the compilation by the Wall Street Journal is given below:

State—	Estimated consumption gallons	Tax cents a gallon	Estimated yield
Alabama	70,767,900	2	$ 1,415,358
Arizona	26,030,600	3	780,918
Arkansas	63,892,350	4	2,555,694
California	593,727,300	2	11,874,546
Colorado	95,961,150	2	1,919,223
Connecticut	97,752,150	1	977,521
Delaware	15,901,200	2	318,024
Dist. of Col.	39,942,900	2	798,858
Florida	87,807,600	3	2,634,228
Georgia	93,459,600	3	2,803,788
Idaho	31,152,150	2	623,043
Indiana	293,267,250	3	8,798,017
Iowa	277,257,600	2	5,545,152
Kansas	184,900,950	2	3,698,019
Kentucky	103,411,800	3	3,102,354
Louisiana	80,100,000	2	1,602,000
Maine	57,230,100	*3	1,716,903
Maryland	89,279,100	2	1,785,582
Michigan	390 395,250	2	7,807,905
Minnesota	226,546,650	2	4,530,933
Mississippi	60,606,000	3	1,818,180
Missouri	243,225,000	2	4,864,500
Montana	35,862,750	2	717,255
Nebraska	138,921,750	2	2,778,435
Nevada	8,153,100	†4	326,124
New Hampshire	31,919,400	2	638,388
New Mexico	18,756,000	3	562,680
N. Carolina	136,004,400	4	5,440,176
N. Dakota	52,805,700	1	528,057
Ohio	558,720,000	2	11,174,400
Oklahoma	166,456,350	3	4,993,690
Oregon	86,676,750	3	2,600,302
Pennsylvania	552,864,150	2	11,057,283
Rhode Island	42,966 900	1	429,669
S. Carolina	72,788,850	5	3,639,442
S. Dakota	64,078,200	3	1,922,346
Tennessee	92,106,000	3	2,763,180
Texas	360,770,400	1	3,607,704
Utah	30,742,200	3.5	1,075,977
Vermont	27,530,550	2	550,611
Virginia	117,875,250	3	3,536,257
Washington	132,949,350	2	2,658,987
W. Virginia	85,830,300	2	1,716,606
Wisconsin	236,349,450	2	4,726,989
Wyoming	19,637,550	2.5	490,938
Totals	6,293,379,950		$139,906,242

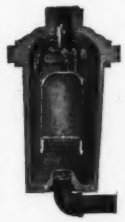
*After July 11. †After July 1.

Eckenroth Automatic Reseating Blow-Off Valve

Will end all your blow-off troubles. Can be repacked and reground under pressure. No expensive special packing rings or repairs. Angle or straightway, screwed or flanged.

Factory Guarantee

We guarantee ECKENROTH VALVES to remain permanently tight without repairs, renewals or grinding, and further, to refund the purchase price if AFTER TWO YEARS' SERVICE the surfaces of disc and seat are not in better condition that when valve was first installed.



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Cannot Waste Steam.
Inlet on Bottom.
Non Air-Binding.
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Large Capacity.
Small in Size.
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Improved Non-Clog Spray Nozzles.
Superheaters for R. T. Boilers.
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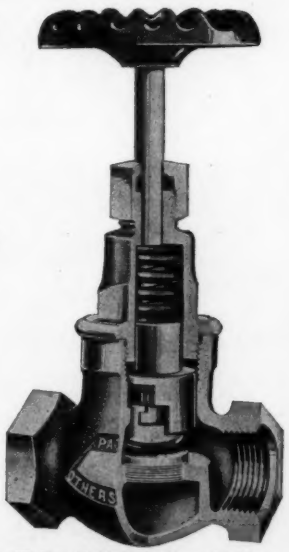

Kelly Self-Grinding Valve
Dallas Stock

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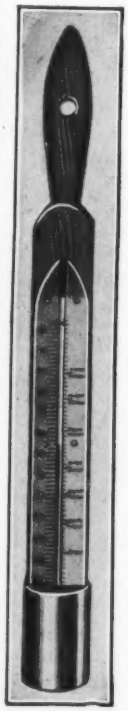

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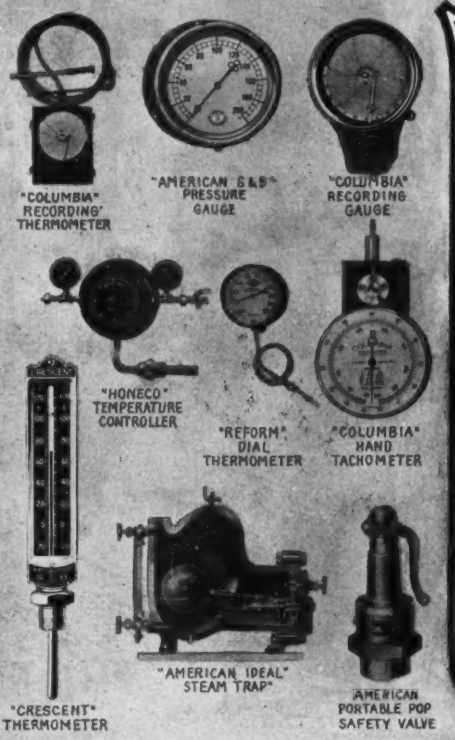

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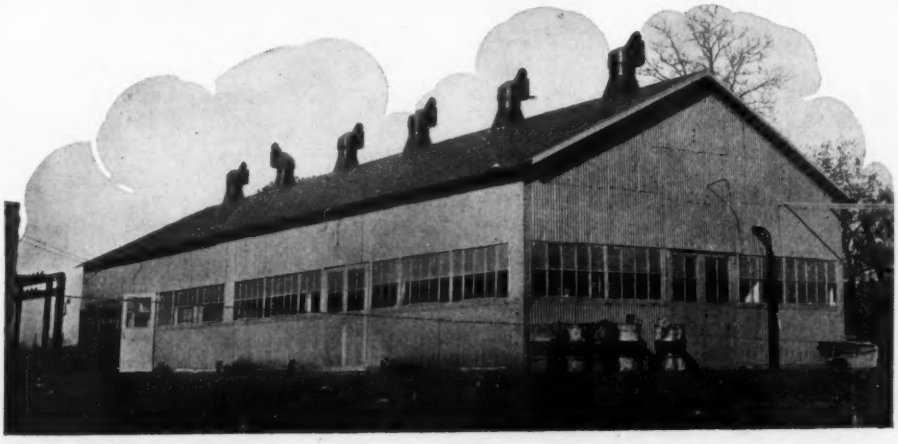

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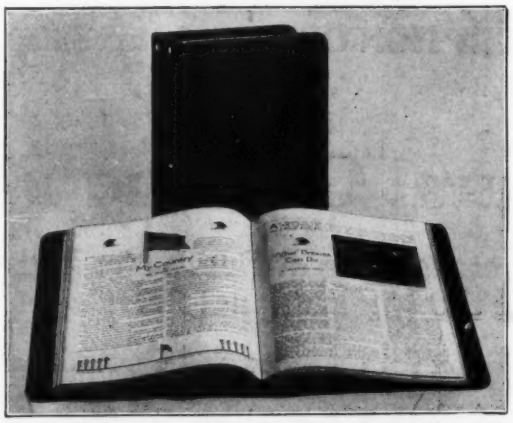

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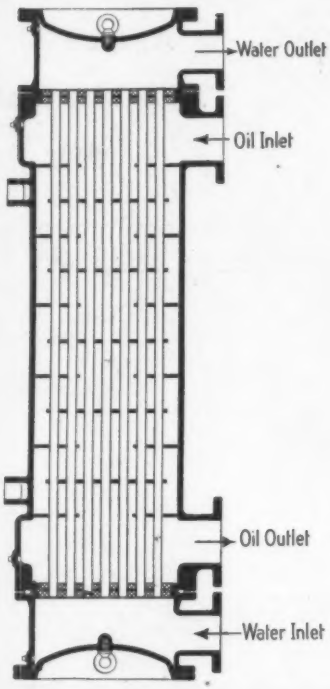

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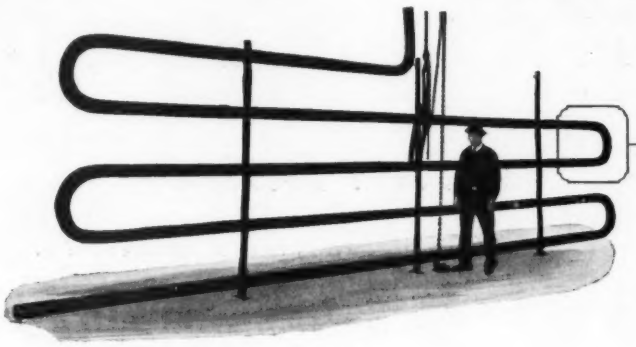

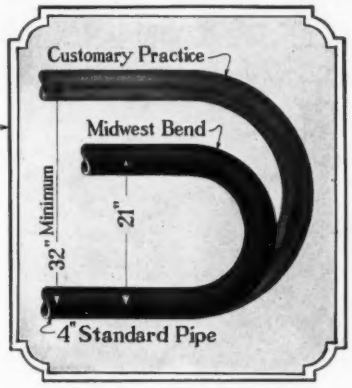

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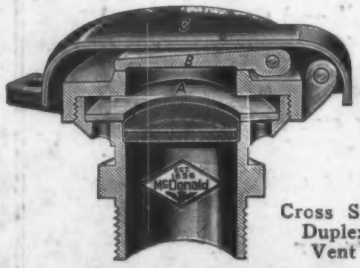

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